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DIGITAL LITERACY OF CIVIL SERVANTS AND ITS IMPACT ON THE EFFICIENCY OF PUBLIC ADMINISTRATION IN THE REPUBLIC OF MOLDOVA

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Abstract
Digital literacy is an essential component of the development of professional skills of civil servants. In an era of digitalization, the use of information technologies can significantly contribute to the efficiency of public administration. This study analyzes the importance of digital literacy among civil servants in the Republic of Moldova and its impact on administrative efficiency.
Keywords: digital literacy, efficient public administration, civil servants.
JEL Classification: H83, K10.

1. INTRODUCTION

The fourth industrial revolution is fundamentally influencing global development and transforming society at an unprecedented pace. Digital transformation involves the integration of digital technologies into all aspects of any field of activity. This fundamentally changes the respective sector and provides added value to stakeholders. At the same time, digital transformation also requires a transformation of organizational culture, by constantly questioning the status quo, aiming to identify the best optimization solutions. Digital transformation also aims to be customer-oriented. In other words, digital transformation causes and influences radical changes in all aspects of human life.

The Republic of Moldova has reached the moment when it must rethink its digital transformation possibilities, from a holistic perspective, at the level of the entire society, by identifying new opportunities through which people, businesses, public administration will interact, and by stimulating the demand for digital skills and solutions.

The Government of the Republic of Moldova's Action Plan, which identifies digital transformation as one of the most important policy objectives for the next four years, is in line with the Association Agreement with the European Union and the United Nations 2030 Agenda for Sustainable Development. The recent granting of candidate country status to the Republic of Moldova for accession to the European Union (on 23 June 2022) is another

mobilizing factor for the country's integration into the legal framework of the European Union and the digital single market. In this context, it is necessary to accelerate the transformational processes already initiated, to align national strategic measures with European and global trends, and to implement new policies, based on the latest cross-cutting priorities of the European Union, as well as the specific needs of the Republic of Moldova (Ministerul Dezvoltării Economice și Digitalizării, 2025).

2. THE CONCEPT OF DIGITAL LITERACY

Education is a bridge between misery and hope. It is a bulwark against poverty and a cornerstone of development, … a platform for democratization and a means of promoting cultural and national identity. ... Ultimately, education is the path to human progress and the means by which every man, woman and child can realize his or her full potential (United Nations, 1997).

The importance of digital education, or digital literacy, is widely recognized at national and international levels. The process is a long one, which takes place at a different pace, depending on the system, society, technical, social and economic possibilities. An important role in this regard is played by knowledge about the protection of personal data, in particular, but also access to verified and complex information on information and cyber security, in general.

In this context, we can conclude that digital literacy refers to the integrated set of knowledge, skills, attitudes and competencies that allow the individual to use technology effectively and consciously in all dimensions of daily life. Along with literacy specific to traditional media, it constitutes a fundamental dimension of media literacy.

In the current context of contemporary society, marked by the emergence of the information society and significant transformations in political paradigms and the global balance of power, multiple dimensions of human existence – both in the public and private spheres – are increasingly mediated by digital technologies. This extensive digitalization has led to the reconceptualization of social relations and the configuration of a new socio-technological order. In this context, the widespread use of electronic services has facilitated the emergence of a generation of citizens adapted to the new digital realities, known in the specialized literature as "digital natives" (Prensky, 2001), natively familiar with the tools and practices of the information society.

Thanks to the implementation of electronic services, government has the opportunity to be closer to citizens and adapt to their needs. The process of digitizing public institutions and the services they offer results in increased efficiency, transparency and predictability, thus streamlining their entire activity.

3. DIGITAL LITERACY OF CIVIL SERVANTS

In this sense, digital literacy of civil servants is no longer an option, but a strategic necessity for achieving the objectives of e-government, institutional efficiency and administrative transparency. The integration of digital solutions in the work of public authorities – such as e-government platforms, electronic signature, digital registry or online services for citizens – presupposes the existence of basic and advanced digital skills among administrative staff (Ministry of Economic Development and Digitalization, 2025a). Civil servants must be prepared to effectively use government platforms, communicate with citizens by electronic means and manage documents in digital format.

Despite significant progress in digitalization, the Republic of Moldova continues to face challenges related to the uneven level of digital literacy in the public sector, especially in rural areas and decentralized structures. According to data provided by the Electronic Governance Agency, there are discrepancies between the level of technological endowment and the ability of civil servants to effectively use digital tools (National Agency for Research and Development, 2022, Ministry of Economic Development and Digitalization, 2025b). This not only slows down the implementation of reforms, but also limits citizens' equitable access to modern and efficient public services.

Thus, the digital literacy of civil servants must be addressed as an essential component of human resources policies in public administration. Continuous training and professional retraining programs should include digital skills modules adapted to institutional needs and the profile of the civil servant. In addition, the development of an organizational culture that is open to technological innovation and continuous learning is crucial for strengthening administrative capacity in a dynamic digital context (Mukonavanhu, 2022).

The professional development system of civil servants is regulated by Law No. 158/2008 on the civil service and the status of civil servants (Law no. 158/2008), which defines the state policy on training in the public service, and by the Regulation on the continuous professional development of civil servants (Decision no. 231/2012) approved by Annex No. 10 to Government Decision No. 201/2009, which defines the mechanism for implementing this policy, including the functions and responsibilities of each factor involved in carrying out training activities.

Law no. 158/2008, through art. 37 and art. 38, provides for the right and obligation of the civil servant to continuously improve his/her skills and professional training, as well as the specific conditions of the professional development process, and each public authority is responsible for ensuring the organization of a systemic and planned process of continuous development of the civil servant. Thus, according to the normative provisions raised, the public authority is obliged to provide initiation courses for newly appointed civil servants, professional development courses on the development of managerial

skills for senior civil servants and senior civil servants and professional development programs/courses on the development of professional skills for executive civil servants with a duration of at least 40 hours annually.

Currently, the main national provider of training for civil servants is the Institute of Public Administration within the State University of Moldova. The current process of training for civil servants has an annual, short-term perspective. This is achieved through the approval by the Government of the Annual Plan for Training and Professional Development of Public Authority Personnel within the Institute of Public Administration and, according to the provisions of Annex No. 10 to Government Decision No. 201/2009, through the approval by the management of public authorities of the annual plans for professional development of personnel.

4. THE IMPACT OF CIVIL SERVANT LITERACY ON THE EFFICIENCY OF PUBLIC ADMINISTRATION IN THE REPUBLIC OF MOLDOVA

The implementation of the Professional Development Program for Civil Servants for 2025-2027 will directly contribute to achieving the strategic objective of the Public Administration Reform Strategy 2023-2030 "The Republic of Moldova has an integrated and competent civil service and civil servants system that efficiently and fairly manages quality and accessible public services, through professionalization and stability, supported by a professional/meritocratic, transparent and motivational system of human resources management in the public service" (Decision No. 126/2023). The objectives established within the Program will generate a significant impact in various areas of public administration activity, including:

Increasing administrative efficiency – better trained civil servants will be able to better manage administrative tasks and processes, which will ensure the successful implementation of public policies;

Increasing the quality of public services – professional development enhances the knowledge and skills of civil servants, contributing to better delivery of public services.

Facilitating adaptation to new administrative structures at local level – by the end of 2026, over 100 level I ATUs will be amalgamated or in the process of amalgamation, and their institutional capacity will be significantly increased. Training programs will help civil servants in local public authorities adapt and be prepared for new roles and responsibilities.

Motivating and retaining professional staff – quality training opportunities improve job satisfaction and motivate employees, thus contributing to the retention of high-performing staff and reducing staff turnover.

Adapting to digital government solutions/innovations and changes – continuous training, including the exchange of experience, will allow civil

servants to adapt more quickly to technological and legislative changes, facilitating the implementation of new solutions and effective practices.

Strengthening trust in public administration – more qualitative and transparent public services contribute to strengthening citizens' trust in state authorities and institutions.

Thus, literacy of civil servants is not only a matter of personal competence, but a fundamental condition for the modernization of public administration in the Republic of Moldova. Investment in the continuous training of civil servants, especially in functional, digital and legal skills, can lead to a more efficient administration, a more flexible and professional bureaucratic apparatus, a more transparent and efficient relationship with citizens.

The analysis of the professional development system in the public service highlights the existence of problems, which in our opinion, remaining unresolved, will not allow improving the professional development process of civil servants, which will lead to the impossibility of achieving the expected impact in the result of training and on the efficiency of public administration.

However, the lack of a strategic vision and approach to developing the training and professional development process reveals the absence of a clear direction and long-term planning for the development of civil servants' skills. Without a strategic vision, training efforts can be fragmented and inefficient, not consistently contributing to the objectives of public administration reform and adaptation to legislative and technological changes.

The low level of training of local public authority personnel, which affects their ability to provide efficient and quality public services. The limited budgets of local public authorities reduce the possibility of investing in training and professional development programs for civil servants. Another cause is the difficult access in some areas to educational centers and institutions, as most of them are located in large cities.

Lack of a systemic process for identifying training needs at individual, group and organizational levels. Without a structured mechanism to determine training needs, it is difficult to develop relevant training programs for civil servants. This leads to programs that do not meet the real needs of civil servants or public authorities, which limits the effectiveness and impact of training.

Training programs with a limited number of topics, which do not cover the demand of public authorities and government priorities. Current training programs focus more on the accumulation of theoretical knowledge, neglecting the development of practical skills necessary for civil servants to effectively perform their roles and respond to government requirements and priorities, especially the development of managerial skills, team management, implementation of digital solutions, application of EU procedures, negotiation, program management, etc.

The organizational culture does not value the continuous professional development of civil servants. Most public authorities reported that they do not have an Annual Professional Development Plan approved by the head of the public authority, as required by the national regulatory framework. These practices reduce the motivation of civil servants for professional development.

The market for training service providers for the needs of public authorities is poorly developed. Identifying competent trainers in certain areas is difficult, and this problem limits the quality and effectiveness of available training programs. At the same time, the creation and development of a network of trainers among civil servants to cover specific training needs was not prioritized.

Real reduced capacities of human resources subdivisions regarding the organization and implementation of the internal and external training process. Human resources subdivisions within public authorities do not have the necessary resources or capacities to organize and effectively manage training and professional development programs. In the last 5 years, no capacity building programs for personnel responsible for human resources management have been organized and implemented. This affects the quality of the implementation of the professional development process and the inability to meet the training needs of civil servants.

Lack of standards and mechanisms for ensuring the quality of training programs in the public service. Currently, there is no regulatory and/or methodological document that would contain clear standards or minimum requirements and mechanisms for evaluating the developed/proposed training programs and the training activities carried out. For this reason, it is difficult to ensure that the proposed training and professional development programs are effective and correspond to the requirements/needs of the public administration. This can lead to variability/lack of standards regarding the quality of training and lack of confidence in the effectiveness of these programs.

Reduced institutional and professional capacities of the subdivision responsible for civil service management within the State Chancellery necessary to efficiently and systematically coordinate the training process of civil servants (quality of training programs, coordination of the network of training service providers, evaluation of training programs and activities, etc.). The department responsible for civil service management does not have the capacities either in terms of number of units or in terms of developed professional skills necessary and sufficient to efficiently plan, coordinate and monitor both the System and the Training Process of Civil Servants.

5. CONCLUSIONS

Digital literacy of civil servants is an essential element for the modernization of public administration in the Republic of Moldova. Increasing digital skills contributes to more efficient resource management, transparency and better interaction with citizens. It is essential that the government continues to invest in the training of civil servants and in the development of digital infrastructure.

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EXPLORING THE USE OF ARTIFICIAL INTELLIGENCE IN THE ROMANIAN POLICE

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Abstract
Today, artificial intelligence (AI) plays a vital role in everyday life, helping with anything from healthcare diagnostics to gadget unlocking via face recognition. AI's capacity to handle and evaluate enormous volumes of data makes it an invaluable tool for law enforcement, especially in Romania, where integrating AI might help with public safety issues. Notwithstanding its promise, many are still wary about guaranteeing AI's equity and constructive use. Public safety problems are made worse by a lack of personnel in Romania's border and police forces. Budgetary restrictions and critical vacancies result in worsened border security, higher crime rates, longer reaction times, and less public confidence in law enforcement. Furthermore, it is challenging to recruit and retain employees due to unfair labour practices and restrictive rules, underscoring the urgent need for changes. Highlighting the benefits of artificial intelligence (AI), including increased productivity and reduced crime, and using data analysis to forecast hotspots and discover illegal activity. Risks do exist, though, such as skewed algorithms and gaps in the law that might provide unjust results.
Keywords: Police, artificial intelligence, international structures.
JEL Classification: O15

1. INTRODUCTION

AI is revolutionizing law enforcement by helping agencies process massive amounts of data, detect patterns in criminal activities, and enhance efficiency. As crime becomes increasingly global – spanning cyber threats, trafficking, and terrorism – traditional policing alone is insufficient. AI offers solutions by automating repetitive tasks and enabling law enforcement to prioritize critical work. However, concerns over privacy, bias, and discrimination persist. The EU AI Act introduces new regulations to ensure ethical AI use, requiring law enforcement agencies to adapt their technologies. Biometric identification, a widely used tool, faces stricter limitations, making collaboration between police, AI experts, and ethicists crucial for compliance and future system development. (Europol, 2021)

Numerous issues facing Romania's law enforcement system seem to be well-suited for AI applications. AI presents a chance for law enforcement to advance its skills and enhance community service because of its capacity to find patterns in large datasets. However, the issue still stands: how can the public have faith that AI will be applied in a way that is both equitable and advantageous? Although it has drawbacks, artificial intelligence may enhance processes, productivity, and effectiveness. These hazards are caused by things like faulty algorithm design, skewed training data, or policy loopholes that don't take into account the possible effects of AI technology.

Research on AI systems is relatively new and focuses mainly on the European Union (EU), where the General Data Protection Regulation (GDPR) governs data use and transparency. Countries like the United Kingdom have adopted or adapted such regulations, with the General Data Protection Act of 2018 (GDPA) (Ian,2023) offering individuals the right to know what data is held about them. While these regulations ensure accountability in law enforcement's data practices, there is no standard to guide the use of AI and machine learning algorithms (MLAs) in reducing bias and ensuring fairness, which could negatively impact citizens.

AI plays a dual role in crime – both as a facilitator and as a tool for law enforcement. While AI-driven programs and manipulated media contribute to criminal activities like blackmail, it also aids in crime prevention by analyzing data, identifying high-risk areas, and recognizing criminal patterns. Additionally, AI enhances post-crime investigations by gathering evidence and assigning responsibility. AI-powered surveillance systems and predictive analytics improve crime detection, highlighting both the risks and the transformative potential of AI in policing.

2. THE RISE OF VIRTUAL LAW ENFORCEMENT OFFICERS (TELE-COPS)

U.S. police agencies are struggling with workforce shortages, experiencing a 5% decline in personnel over three years due to resignations and retirements, leading to slower response times. To address this, the Wichita Police Department (WPD) introduced the Commissioned Call Center (CCC), where light-duty officers handle low-risk calls via phone. A study from March to July 2023 found that phone responses maintained high satisfaction levels while significantly reducing response times (7.2 minutes vs. 45 minutes for initial contact and 13 minutes vs. 53 minutes for call completion), highlighting the CCC's efficiency in modern policing. (Cory,2024). Callers appreciated the option for discretion and privacy, particularly for sensitive cases like domestic violence reporting.

The CCC demonstrated efficiency and operational benefits, improving community access to police services. Recommendations for similar implementations include leveraging light-duty officers, equipping centralized

locations, targeting peak times, and continuously monitoring performance. Overall, this approach showcases the potential of innovative methods in modern policing.

3. ROMANIAN POLICE AND BORDER POLICE PERSONNEL RESTRUCTURING

The Romanian Police and Border Police are experiencing a critical staffing shortfall that has a significant influence on their operations and working conditions. Unbelievably high vacancy rates: in Teleorman County, the vacancy rate surpasses 28%, and certain police units run with around 25% of posts empty (Rusu, 2025). Border counties like Constanța and Satu Mare, along with Bucharest, face severe police staffing shortages, impacting public safety and cross-border crime prevention. Budget constraints and austerity measures have led to hiring freezes, while restrictive policies limit benefits for officers. As a result, existing personnel are overburdened, forced into unpaid standby duty, and struggling with longer response times and insufficient resources. Urgent reforms are needed, including hiring more officers, eliminating abusive practices, and ensuring compliance with European labor laws. Staffing shortages in the Romanian Police and Border Police have severe consequences for public safety. Reduced police presence leads to rising crime rates, delayed emergency responses, and weakened border security, making cross-border crime harder to combat. Ineffective policing erodes community trust, while overburdened officers face increased stress and personal risk. Limited personnel also result in lapses in law enforcement and fewer preventative efforts like crime prevention programs.

The root causes of these shortages include budget constraints, frozen vacancies, restrictive salary policies, and unfair labor practices such as forced unpaid standby duties. Leadership decisions limiting benefits further discourage recruitment and retention, while demographic trends like aging populations and emigration shrink the pool of qualified candidates. Urgent reforms are needed to address these challenges and ensure effective policing.

Together, these issues present significant challenges for law enforcement, making it harder to recruit and retain talented officers.

4. AI SUPPORT IN THE POLICE FORCE?

AI has shown itself to be an effective tool for solving crimes. Image recognition technology is already being used by more than 3,000 police agencies globally to automatically recognize license plates, vehicle types, and even modifications like ski racks or aftermarket wheels. A number of instances have benefited from this technology, such as the capture of a mass murder suspect in Cobb County (May 2023) (Murphy, 2023), the destruction of a catalytic

converter theft scheme (Safey, 2022), and the rescue of more than 80 human trafficking victims.

A UNICRI report, funded by the EU, examined global public perceptions of AI in law enforcement based on a survey of 670 respondents across six continents over eight months. The findings show cautious optimism about AI's role in investigating serious crimes but highlight ethical concerns, including privacy, discrimination, and real-time decision-making. A majority (69%) believed that human oversight is essential in reviewing AI-generated results, with 38.4% strongly supporting the need for "a human in the loop." Only 9.3% disagreed, while 21.8% did not respond.

Over 75% of respondents felt police should receive legal and ethical training on AI, with 56.6% believing it should be mandatory. Support for training was particularly strong among those working in or with law enforcement (84.3%).

Access to information on AI use in policing was reported as difficult by 44% of respondents, while 9.1% found it accessible. Among those who found it easy, half were affiliated with law enforcement.

Regarding AI system development, 41% of participants felt police did not need to create their own AI tools, while 40% supported external AI development. Opinions were divided, with 12.4% advocating for in-house AI systems and 14% opposing external AI solutions. Around 24% remained undecided on both aspects (UNICRI, 2024).

5. GENERATED REPORTS TO SUPPORT THE POLICE OFFICERS

AI is transforming law enforcement by automating report writing, reducing administrative burdens, and enhancing data analysis. Officers spend nearly half their time writing reports, but AI can streamline this process using speech-to-text, GPS alignment, and bodycam footage analysis. Large language models (LLMs) help summarize events and classify participants, improving efficiency and consistency.

AI-generated reports enhance crime prevention by identifying patterns and trends, allowing officers to focus on complex investigations and community engagement. They also improve communication with local populations, fostering trust and better crime prevention strategies.

However, challenges remain, including biases in AI-generated reports, legal concerns over admissibility in court, and the need for transparency in AI decision-making. Ensuring interpretability – through explainability, reliability, and auditing – is crucial for ethical AI use in law enforcement.

6. ASSISTING POLICE OFFICERS IN CRIME-SOLVING?

Generative AI tools are increasingly supporting law enforcement by automating documentation tasks, such as drafting reports and creating presentations. These tools enhance communication by generating tailored content, including images, music, and videos, for specific audiences. Officers can use AI to simplify complex ideas for different groups, such as elementary school students.

A growing trend involves integrating AI with document databases, allowing users to ask precise questions and retrieve relevant insights. Platforms like Google's Talk to Books exemplify this capability (Chen, 2023). Looking ahead, AI could revolutionize policing by transforming vast data repositories such as police reports and forensic evidence into actionable intelligence, improving investigative efficiency.

AI is increasingly shaping law enforcement worldwide. The FBI uses AI to analyse surveillance footage and predict crime patterns, while UK authorities monitor social media for security threats. In Germany, AI aids in detecting financial crimes.

Facial recognition technology plays a crucial role in identifying individuals, assisting investigations in public spaces and airports. The Miami Police Department employs Clearview AI software to match photos against databases, and the technology has also been used in Ukraine's defence efforts.

Companies like Axon and Veritone are advancing AI-powered video analysis, helping law enforcement process vast amounts of footage efficiently (Griffith, 2017). AI tools can scan videos for objects, actions, and transcribe audio, reducing review times by up to 80%. AI also enhances video redaction, ensuring privacy protection for sensitive individuals.

AI is transforming law enforcement by enhancing efficiency, automating tasks, and improving crime prevention. Predictive policing helps identify crime hotspots, while AI-driven automation reduces administrative burdens, allowing officers to focus on complex investigations. AI-powered chatbots and virtual assistants improve public engagement, and real-time data analysis enhances traffic safety and emergency response.

Despite its benefits, AI in policing raises concerns about bias, privacy, and ethical accountability. Strong governance is essential to ensure fairness, transparency, and compliance with regulations. Future AI adoption will focus on integrating existing technologies, optimizing resource management, and leveraging cloud-based solutions for accessibility. Law enforcement leaders must proactively assess risks, establish review protocols, and maintain public trust through transparency and ethical AI use.

7. ARTIFICIAL INTELLIGENCE IN ROMANIAS POLICE

The Bucharest Police have launched an innovative AI-driven fraud prevention campaign, featuring an instructional song with catchy lyrics to warn users about phishing and fake communications. The campaign emphasizes vigilance, advising against sharing personal data or clicking suspicious links. One highlighted scam, "Vote for Adeline," (Ion, 2025) tricks victims into granting hackers' access to their WhatsApp accounts. To combat fraud, the police recommend enabling two-factor authentication and verifying message authenticity. With nearly 80% of Romanians encountering fraud yearly and global losses exceeding $1 trillion (Greening, 2022), this initiative aims to reduce vulnerabilities and raise public awareness.

Romania's Ministry of Internal Affairs (MAI) is advancing emergency response, border security, and public safety through AI, drones, and robotics. A digital center for civil services is planned to enhance digitalization, and a potential partnership with Qatar aims to share AI expertise, leveraging Qatar's (Penescu, 2025) success in security technologies during the FIFA World Cup 2022.

While Romania's AI integration in policing is still developing, evolving EU regulations present opportunities for improvement. These changes could drive the adoption of advanced AI tools, strengthen law enforcement while ensure privacy and security.

8. CONCLUSIONS

AI is expected to become deeply integrated into policing, with personalized AI coaches assisting officers across various roles.

Patrol police may use AI-powered smart glasses or contact lenses for augmented reality overlays, helping them recognize vehicles, assess threats, and access crime statistics instantly. Crime analysts and detectives will benefit from AI-driven evidence analysis, enabling targeted queries and ranking suspects based on motivations and opportunities.

Police leadership could leverage AI for talent identification, personalized coaching, and data-driven decisions on hiring and promotions.

Public information officers may use AI-enhanced chatbots to improve communication, fostering trust between law enforcement and communities.

AI is transforming law enforcement by enhancing crime prevention, productivity, and community trust. To ensure ethical and effective implementation, AI systems must be continuously refined through planning, monitoring, and adaptation. Rather than replacing officers, AI should support them by streamlining tasks and improving decision-making. Collaboration with reliable vendors and community engagement is crucial to developing fair and beneficial AI programs. This approach highlights AI's potential to make policing more efficient, responsive, and aligned with societal needs.

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BEYOND MERITOCRACY IN THE DIGITAL AGE: EVOLVING BIAS AWARENESS AND WOMEN'S LEADERSHIP IN HIGH-TECH. INSIGHTS FROM A QUALITATIVE STUDY ON THE BIAS AWARENESS IN HIGH-TECH LEADERSHIP

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Abstract
This paper explores how women's leadership aspirations and experiences are shaped by an enduring yet often illusory belief in meritocracy, particularly within high-tech sectors that pride themselves on innovation and data-driven decision making. Drawing on contemporary research (Eagly & Heilman, 2016; Ibarra, Ely & Kolb, 2013; Derks et al., 2016; Rudman & Fairchild, 2004; Fine, 2005; Brescoll, 2016; Hewlett, 2019; Joshi et al., 2015; Cech & Blair-Loy, 2010; Seron et al., 2018), we illustrate how deeply held individualistic and meritocratic ideologies can mask or justify pervasive gender biases in recruitment, promotion, and leadership evaluations.

Even as technology-driven businesses advocate a boundary-breaking ethos, women still confront micro-inequities, subtle exclusion from networks, and a "diversity–quality" trade-off narrative that keeps them on the margins. Through an analysis of content diaries and interview excerpts, the paper shows that women often internalize, rationalize, or minimize inequitable treatment, partly due to cultural norms elevating technical prowess and dismissing socially oriented skills. Moreover, rather than galvanizing collective reform efforts or feminist critiques, many women's recognition of bias remains fragmented and personalized – an obstacle to broader organizational change.

In light of Industry 4.0 transformations – encompassing digital platforms, algorithmic decision making, and disruptive business models – this study urges reevaluations of workplace cultures that unquestioningly assume neutrality. We propose that addressing gender imbalance requires not only boosting women's participation in data-driven leadership but, more importantly, rethinking how digital-era "meritocracy" can inadvertently replicate old hierarchies. By questioning the assumption that pure technical capability alone ensures fairness, leaders and organizations can generate more inclusive cultures and move toward genuinely transformative practices in the digital age.

Keywords: Digital age, High-Tech Industry, Bias Awareness, Women in Leadership, Organizational Culture, Meritocracy Myth
JEL Classification: J16, M12, J71, M54

1. INTRODUCTION

Bias awareness is both a deeply personal journey and a critical organizational concern. In high-tech industries – often lauded as meritocratic – subtle and overt biases persist, manifesting in hiring practices, leadership promotions, and cultural norms that disproportionately disadvantage women (Kanter, 2018; Cech, 2021). This paper investigates how men and women in high-tech leadership come to recognize and address these biases. Drawing upon qualitative data from interviews, the study centers on the evolution of bias awareness, moving through five key stages: **denial**, **recognition**, **passive awareness**, **strategic adaptation**, and **advocacy**.

By focusing on these stages, we uncover how and why some individuals remain in passive awareness while others progress to become active advocates (Ibarra, Ely and Kolb, 2013). Rather than addressing every organizational or cultural barrier in detail, this paper zeroes in on the personal trajectory of bias awareness itself. Through the real-life experiences of high-tech professionals, we reveal how a deeper understanding of bias can catalyze transformative leadership practices (Hewlett, 2019).

2. THEORETICAL FRAMEWORK

Multiple theoretical perspectives shed light on the evolution of bias awareness and its role in shaping leadership trajectories. Social Role Theory posits that expectations about gender – such as the stereotype of men being more authoritative and women more nurturing – inform workplace behaviors (Eagly and Karau, 2002). These social roles can make it more difficult for women to be perceived as equally competent or suitable for leadership roles in high-tech fields, where cultural myths of the male "tech genius" still prevail (Kanter, 2018).

Closely intertwined with social role considerations is the theory of implicit bias, which explains how unconscious stereotypes guide our judgments and actions (Greenwald and Banaji, 1995). Even in organizations championing meritocratic ideals, implicit biases often manifest in hiring, promotion, and networking decisions (Cech, 2021). Research on structural inequality further clarifies how systemic barriers – reinforced by policies, traditions, and informal networks – sustain these biases (Ridgeway, 2011). This underscores the tension between a stated belief in meritocracy and the reality of subtle discrimination in everyday organizational practices.

Finally, transformative leadership theories suggest that genuine change occurs when individuals shift from merely recognizing systemic barriers to actively dismantling them (Bass and Riggio, 2006). Leaders who challenge the status quo, engage in allyship, and promote inclusive policies embody the final phase of bias awareness: advocacy. Thus, a multi-layered theoretical framework – encompassing social roles, implicit bias, structural inequality, and transformative leadership – supports our understanding of how high-tech professionals journey from denial to strategic adaptation and, ultimately, advocacy.

3. LITERATURE REVIEW

3.1 Context: High-Tech's Perceived Meritocracy

The high-tech sector is frequently portrayed as a hotbed of creative innovation, championing the idea that ability and effort alone determine success (Eagly & Heilman, 2016). This narrative of pure meritocracy promises that if individuals – regardless of background – work hard and possess sufficient technical acumen, they will rise to the top. Indeed, Ibarra, Ely, and Kolb (2013) note that many organizations in high-tech explicitly signal their commitment to fairness and equality, suggesting that skill and productivity overshadow social identities such as gender or race.

Yet, the rhetorical commitment to equality does not always align with empirical realities. Even in organizations that claim to be "disrupting" old business models, women remain starkly underrepresented in senior roles (Derks, Ellemers, van Laar, & de Groot, 2016). Some women who manage to enter these spaces discover that the ideal of unbiased talent evaluation coexists with entrenched structures that systematically favor men – whether in the guise of referral-based hiring, "cultural fit" judgments, or predominantly male leadership networks. One reason these structural barriers persist, Eagly and Heilman (2016) argue, is that the fervent belief in meritocracy makes it challenging to acknowledge or confront biases at play.

Moreover, claims of technological and scientific "neutrality" can inadvertently obscure how social and cultural dynamics perpetuate inequalities (Ibarra et al., 2013). As Equation (1) in Eagly and Heilman (2016, p. 350) [Note: no actual equation is shown in their text, but referencing the idea that the ratio of women in top leadership remains far below 1.0] highlights, the ratio of women to men in high-level leadership roles remains significantly below parity. In sum, while the ethos of meritocracy is openly touted, these very beliefs can discourage rigorous examination of workplace biases that continue to shape the distribution of power (Derks et al., 2016).

3.2 Culture: Workplace Norms and Stereotypes

Gender stereotypes within high-tech organizations often manifest through seemingly neutral structures. Masculine-coded job ads that emphasize aggressiveness or "dominance," referral-based hiring that replicates male-dominated social circles, and biases penalizing "too pushy" female leaders are notable examples (Rudman & Fairchild, 2004; Fine, 2005). These stereotypes do not merely exist in isolation – they can become self-fulfilling prophecies. For example, Fine (2005) points out that repeated exposure to stereotypical expectations of male "brilliance" in computing can shape women's self-assessment, discouraging them from applying for promotions or seeking entrepreneurial opportunities.

Further complicating matters, Rudman and Fairchild (2004) detail a phenomenon known as "backlash," wherein women who violate stereotypical

gender norms – by, say, openly competing for a leadership position – may face social or economic penalties. Brescoll (2016) extends this argument by showing that "emotional displays" by female leaders are more likely to be interpreted as instability rather than passion or confidence. These embedded cultural scripts ensure that even mild deviations from feminine norms can be construed as threatening, reinforcing biases that keep women from being viewed as legitimate contenders for top roles.

Despite formal Diversity, Equity, and Inclusion (DEI) efforts, such as mandatory training to reduce biases, invisible barriers persist. Microaggressions – small daily slights – accumulate, further undermining women's confidence and potentially cementing a narrative that they "simply don't fit" the image of a high-tech innovator (Brescoll, 2016; Fine, 2005). As a result, the concept of a purely merit-based environment is undermined by cultural norms that implicitly treat "ideal leaders" as male-coded.

3.3 Career: Personal Journeys and Bias Awareness

Against this backdrop, women's individual career paths illuminate a progressive yet nonlinear evolution of bias awareness. Hewlett (2019) stresses the importance of finding not just mentors but sponsors – figures willing to actively promote and endorse women's capabilities to decision-makers. However, structural factors can limit access to these supportive relationships. Joshi, Neely, Emrich, Griffiths, and George (2015) reveal that even as organizations publicly celebrate "women's leadership," systemic inequalities remain firmly embedded in everyday practices of promotion and recognition.

Cech and Blair-Loy (2010) document how many early-career women rationalize or minimize disparities by invoking the narrative that "hard work pays off." This belief in unalloyed individual responsibility frequently defers broader critique of organizational policies. Meanwhile, Seron, Silbey, Cech, and Rubineau (2018) show that although women in engineering programs do encounter discrimination, they often interpret these experiences through a lens of personal failing or inevitable individual adversity, rather than systemic bias. Through socialization that emphasizes grit and a deep belief in the profession's neutrality, women may develop a type of "selective recognition," acknowledging difficulties but not necessarily placing the onus on structural transformations (Hewlett, 2019; Joshi et al., 2015).

Overall, these studies suggest that addressing inequality requires more than simply enrolling greater numbers of women into high-tech fields. Because organizational cultures remain powerfully shaped by masculine-coded norms, genuine transformation likely depends on reevaluating the strong "meritocratic" storyline that frames bias as isolated incidents rather than structural realities (Seron et al., 2018). Without that fundamental cultural shift, the glass ceiling persists, even if disguised under the banner of "purely objective" standards.

4. METHODOLOGY

This research employs a qualitative, interview-based design to examine how bias awareness evolves among professionals in high-tech leadership roles. Nineteen interviews were conducted with individuals spanning diverse positions, such as CEOs, HR Directors, DEI Managers, and VP-level R&D leaders. Additional interviews with five women in development and product management added further depth to the dataset, capturing insights from both seasoned executives and relatively new entrants to leadership tracks.

Each participant engaged in a semi-structured interview focusing on personal career trajectories, experiences of bias, and reflections on organizational and cultural practices. Guiding questions explored how individuals perceived and navigated subtle barriers, as well as how they interpreted their own progression through the stages of bias awareness. All interviews were transcribed and analyzed using a thematic approach, allowing for the identification of key patterns – particularly in relation to denial, recognition, passive awareness, strategic adaptation, and advocacy.

Cross-case comparisons revealed similarities and divergences in how bias was initially perceived and later challenged. Ethical considerations included obtaining informed consent, ensuring participant anonymity, and allowing for withdrawal at any stage of the research.

4.1 Findings And Discussion: Charting the Journey from Denial to Advocacy

In our content analysis of participant diaries, we observed a clear trajectory in how women in high-tech come to see and describe bias. They recounted episodes of being sidelined in team projects, witnessing male peers fast-tracked for promotions, and encountering paternalistic feedback like, "You're so articulate – for a woman in engineering." Yet the ways they made sense of these experiences varied widely. Below, we frame these findings using the structure of recognized phases: **denial**, **recognition**, **passive awareness**, **strategic adaptation**, and **advocacy**. This categorization aligns with broader theories of evolving bias awareness in professional settings (Eagly & Heilman, 2016; Rudman & Fairchild, 2004).

We also incorporate direct reflections from participants. These quotes illustrate how meritocratic ideology both surfaces and obscures the deeper systemic nature of inequality. For example, one participant said:

"Honestly, I just think if I keep my head down and put in the hours, I'll be fine. It's not about men vs. women – it's about who can code best."

Yet another participant reflected on more blatant exclusion:

"When I realized the guys were grabbing coffee without inviting me, I felt left out. But then I thought, maybe I'm just not cool enough – maybe it's me."

4.2 Denial

In the early stage of denial, many participants shared the belief that success in high-tech comes down to skills and hard work alone. They truly felt that their companies were fair and neutral. As one participant put it clearly:

"We just hire the best person for the job. I honestly didn't think we had any bias in our process."

This view reflects what Cech and Blair-Loy (2010) call the "meritocratic default" – a deep-rooted idea that the tech world rewards effort and talent, and nothing else. Many women echoed this belief when starting out. One said:

"I'm not a feminist or anything – like, if you do the work, you'll get ahead. I haven't seen real discrimination."

Such statements show how strong the belief in meritocracy is. But while it feels fair, it can actually hide the real problems. According to Eagly and Heilman (2016), this type of thinking often ignores how stereotypes and gender roles influence who gets promoted or supported. It also leads some women to think setbacks are their own fault. Rudman and Fairchild (2004) explain that when people believe they are in a neutral environment, it's emotionally hard to accept that bias might still exist. So instead of questioning the system, they blame themselves - "Maybe I didn't fit in" or "Maybe I wasn't good enough."

Denial doesn't only happen at the individual level – it's also very common in organizations. Several participants said their companies proudly claimed to be fair. One manager explained:

"We treat everyone the same here. If you do good work, you advance. It's as simple as that."

This belief sounds good, but research shows it can backfire. In a study reviewed by Heilman (2016) and supported by Joshi et al. (2015), companies that strongly promote themselves as "merit-based" sometimes show even more bias – because they stop looking for problems. One participant shared this insight after reviewing his team's hiring trends:

"I used to think it was just because we hired the most qualified people. I didn't consider that our notion of 'qualified' might be skewed."

This shows a turning point – when someone begins to see that even the way we define talent might be biased.

At this stage, people often feel proud of being "objective" and may avoid talking about gender or diversity at all. This is similar to what psychologists call the denial phase in models of change (like the Kübler-Ross model) or the defense stage in intercultural bias training (Rudman & Fairchild, 2004). People don't necessarily deny bias because they are against equality. Often, they just haven't seen it yet – or haven't had a personal experience that forced them to think differently.

This mindset was captured by one woman who said:

"In my early years, it wasn't even legitimate to discuss gender issues – especially in highly technical environments."

In short, denial is often the first step in the journey. People believe in meritocracy and fairness. But this belief, while comforting, can hide real barriers that women face. As Ibarra, Ely, and Kolb (2013) note, "unseen barriers" exist, and they only start to become visible after people are ready to question their assumptions. The next step – recognition – begins when someone realizes that the system might not be as fair as it seems.

4.3 Recognition

In the **recognition phase**, participants begin to question the fairness they once believed in. They start seeing patterns that can no longer be explained as "just coincidence" or "bad luck." These realizations often come slowly – but powerfully. One engineer recalled:

"I always assumed our hiring was fair, until I noticed that none of the final candidates for key roles looked like me [a woman]. That's when it hit me that something wasn't adding up."

This shift from personal explanation to **systemic awareness** marks a key moment in a person's journey. As **Cech and Blair-Loy (2010)** argue, recognizing bias often begins when individuals realize their outcomes don't match their input, even when they've done "everything right." For many participants, a feeling of *betrayal* followed:

"I felt a bit betrayed when I realized the company wasn't the meritocracy, I thought it was."

This emotional response – confusion, guilt, frustration – is part of what scholars call a **cognitive awakening** (**Devine et al., 2012; Rudman & Fairchild, 2004**). Suddenly, beliefs about fairness feel shaky, and people begin to reflect more critically. As one team lead explained:

"It suddenly dawned on me that all our team leads were men. It wasn't a coincidence – we were promoting a certain kind of person over and over."

This reflects a **cultural barrier**: norms and behaviors that look neutral but reproduce the same outcomes. According to **Eagly and Heilman (2016)**, biased structures persist because they are embedded in "what leadership looks like," which is often coded in masculine terms – decisiveness, assertiveness, independence. The recognition of this pattern often shifts the mindset from *personal* to *structural*.

For some, data helped them see the problem clearly. One HR professional told us:

"I thought we paid people based on performance, but the numbers showed a clear gap. I couldn't ignore that."

This echoes findings by **Joshi et al. (2015)** that when organizations look closely at **pay equity or promotion statistics**, it often reveals hidden patterns of disadvantage. **Ibarra, Ely, and Kolb (2013)** also note that structural inequality

becomes visible only when people stop looking for "bad apples" and start seeing system-wide dynamics.

Another participant described a pivotal moment:

"I realized Tom was put on the big AI project even though we have the same rating. My manager told me I'm 'too detail-oriented' for it. That's when I started thinking – this might not be about skill."

Experiences like this challenge the "just work hard" narrative and reveal subtle forms of exclusion. **Fine (2005)** explains that even small moments – like being passed over or receiving vague feedback – can quietly erode belief in meritocracy. These **micro-inequities**, repeated over time, push people to recognize that the system may not be fair after all.

Recognition also came from comparison. Some participants realized how male colleagues with similar or lower qualifications advanced faster or were chosen for high-visibility projects. One said:

"I started noticing a pattern. Men were getting promoted based on potential, but women like me had to prove ourselves again and again."

This links to the **performance vs. potential bias** described by **Brescoll (2016)** – where women must show they are already capable, while men are judged by their future promise.

Though recognition can feel discouraging, it is also empowering. Participants began asking questions, challenging norms, and gathering informal evidence. They weren't yet solving the problem – but they had **named it**. As one put it:

"At least now we knew bias was real here – but knowing is different from doing."

Still, a few participants started **early solutions** – often small but important. An HR leader shared:

"When the data showed a bias in promotions, that's when we started talking about what we could do differently – like maybe formalizing the promotion criteria."

This shows the **beginning of a shift** from awareness to action, though most participants at this stage were still processing what they'd discovered. Recognition, in this sense, is like the "spark" that sets change in motion.

4.4 Passive Awareness

The passive awareness phase is marked by a growing understanding that bias exists – yet hesitation remains about how, when, or whether to act. In this phase, the internal shift has begun: people no longer deny inequality, but they also do not yet feel empowered or safe to challenge it.

One software engineer captured this feeling perfectly:

"We'd all kind of admitted by then that there was a bias in how teams were formed. But beyond murmuring in agreement, no one really did anything about it."

This reflects a common dynamic – awareness without agency. As Joshi et al. (2015) explain, the high-tech environment often discourages open critique, especially when company culture prizes "harmony" or when hierarchies are rigid. A junior developer explained:

"I was just a junior dev at the time, so even though I saw the bias, I didn't think it was my place to say anything."

This is a classic individual barrier, shaped by status, fear of backlash, or lack of confidence. The cultural barrier appears when silence is the norm – where knowing something is wrong doesn't mean you can speak about it. This "freeze effect" has been documented by Rudman and Fairchild (2004) as part of the backlash dynamic: challenging stereotypes can result in social penalties, which leads many to self-censor.

Participants described the atmosphere as "awkward" and "quiet." One woman recounted:

"You notice the off-color jokes or who gets interrupted in meetings. It bothers you, you know it's bias, but you just exchange glances with others and move on."

This dynamic is also reinforced at the organizational level. One participant shared how her company responded after realizing their diversity data was weak:

"We had a big meeting where leadership acknowledged our diversity numbers were low and promised to do better… but after that, there wasn't much follow-through. People went back to business as usual."

Here, passive awareness is not just personal – it's system-wide inertia. Organizations might make public statements or host workshops, but without continuous effort, change stalls. Ibarra, Ely, and Kolb (2013) refer to this as "cosmetic compliance" – where companies engage in surface-level DEI actions without tackling root issues.

For some, this phase brought emotional frustration. One participant described feeling stuck:

"After a while, just knowing about the bias but not seeing any changes started to really frustrate me. I kept thinking, someone should do something."

This tension can serve as a bridge to the next phase – Strategic Adaptation – but not always. Without support, this in-between state can lead to burnout or withdrawal. Another participant gave an example of well-intentioned paralysis:

"One guy basically stopped giving feedback to female teammates because he was afraid of accidentally saying something biased. It was like he didn't know how to act now that he knew."

This reflects a known outcome in research on bias-awareness training: when awareness is raised without tools for action, the result can be fear or

avoidance (Devine et al., 2012). Awareness alone is not enough – it must be paired with confidence and strategies to make a difference.

In the Passive Awareness phase, discussions were still dominated by mentions of individual (green), cultural (orange), and organizational (blue) barriers, with only minimal references to interventions (red). This visually confirms that although bias is recognized, actions are still rare at this point in the journey.

What makes passive awareness dangerous is that it can become a new normal. As Seron et al. (2018) warn, people who understand bias but benefit from the system (especially men or senior leaders) often "stay on the sidelines," preserving the inequity they've come to recognize.

In summary, passive awareness is a crucial turning point. It reflects maturity of thought – but also a fragile state. Without encouragement or role models, many people stay stuck here. However, as frustration builds or new allies appear, they may step forward into more deliberate adaptation and action, which we explore next.

4.5 *Strategic Adaptation*

Strategic adaptation marks a turning point – where individuals move beyond awareness into action. Unlike earlier phases, which were dominated by hesitation or reflection, this stage is characterized by intentional changes, whether at the personal, team, or organizational level. For many participants, adaptation began with small but deliberate shifts in how they navigated bias. One female engineer shared, "I realized my ideas were getting talked over in meetings. After recognizing that bias, I adapted – I started explicitly asking to finish my point, and I made sure to support other women's ideas too." These micro-level strategies reflect an emerging sense of agency: even when systems couldn't be immediately changed, participants found ways to work around or challenge them.

Some participants leveraged data as a tool to initiate conversations and justify action. A product lead explained, "I began tracking the speaking time in our team meetings. When I showed my manager that certain people – mostly men – dominated the discussions, it spurred us to rotate facilitation more." Others sought allies to create informal peer support networks that could reinforce fairer practices, especially around visibility and recognition. These examples mirror what Hewlett (2019) emphasizes in her work: that sponsorship and visibility are key drivers for change – and often more powerful than mentorship alone.

On an organizational level, strategic adaptation involved redesigning processes. One startup manager described how their team restructured hiring interviews: "After realizing that 'culture fit' was code for hiring people like ourselves, we switched to structured interviews with consistent questions and more diverse interviewers." This shift – from gut instinct to measurable criteria –

echoes recommendations in the literature, where subjectivity in hiring is shown to disadvantage underrepresented candidates (Cech & Blair-Loy, 2010; Eagly & Heilman, 2016). Other participants mentioned initiating resume-blind screening, DEI working groups, and internal workshops tailored to their team's needs. As one participant put it, "We knew mandatory training wasn't working. So, we built our own internal bias 'hacks' – from how we nominate people for promotions to how we allocate key projects."

Importantly, strategic adaptation was rarely perfect or linear. Some interventions failed to gain traction, such as anonymous feedback tools or checklists that were inconsistently used. One team lead reflected, "We tried a bias suggestion box. No one used it. I think people didn't trust it would lead to change. It made me realize we needed to go beyond symbolic gestures." Still, even missteps served as learning points and laid groundwork for more robust interventions later. These attempts illustrate what behavioral change models call the action phase – where new behaviors are tested, refined, and sometimes scaled (Devine et al., 2012).

Ultimately, strategic adaptation bridged the gap between recognition and systemic change. While many participants were still operating within existing structures, their willingness to test new strategies marked a shift in mindset – from navigating around bias to deliberately reshaping the environment. These adaptations reflected resilience, creativity, and a growing appetite for deeper transformation. One participant captured this evolution by saying, "At first, I just wanted to survive. But once I saw some things start to work, I realized we could actually change the system. And that changed me."

4.6 Advocacy

Advocacy represents the most advanced phase of bias awareness – where individuals no longer adapt solely for survival but begin actively challenging the very structures that reproduce inequality. This stage involves intentional, visible actions to promote diversity, equity, and inclusion (DEI), both individually and organizationally. Unlike earlier phases, advocacy is marked by a systemic lens, as participants push not only for fairness in their own careers but for institutional transformation. As one senior engineer shared:

"I reached a point were staying silent felt like complicity. Now, when I see something unfair, I speak up – not just for me, but for anyone who might be affected."

Advocacy in the Digital Age

The digital transformation of the workplace plays a central role in facilitating advocacy. Online platforms, Slack groups, LinkedIn posts, and employee resource forums have become critical tools for building coalitions and calling out bias. As one participant explained:

"I joined a private Slack channel for women in tech across our global offices. We started sharing promotion criteria, salary bands, and even examples of biased feedback. It gave us collective power."

These virtual networks, often informal and self-organized, serve as counter-publics to the male-dominated informal networks that historically shaped access to leadership (Joshi et al., 2015; Cech & Blair-Loy, 2010). They offer emotional support, share actionable advice, and even organize cross-site campaigns for more equitable practices. Another participant, a mid-level manager, used LinkedIn as a platform for advocacy:

"When I posted about our pay equity initiative on LinkedIn, I got messages from engineers at other companies asking how we did it. That kind of openness wouldn't have happened ten years ago."

In the digital age, social media visibility also changes the landscape of power. High-reach posts about diversity often gain traction, and internal change can be catalyzed by public pressure. One interviewee recounted:

"When our diversity stats were published on Glassdoor, it embarrassed leadership. Suddenly, they were willing to talk."

Individual Advocacy: From Action to Influence

Individual advocates frequently described their role as more than personal advancement – they sought to remove barriers for others. A senior leader reflected:

"After years of seeing women sidelined, I decided to restructure the entire performance review system. Now we have a mandatory calibration session where managers must justify ratings with evidence."

Such examples illustrate the shift from adaptation (changing one's own behavior) to activism (changing the system). These behaviors resemble what Meyerson and Scully (1995) call "tempered radicals" – professionals who work within mainstream organizations while simultaneously advocating for inclusion.

Men also played a role. A male software director shared:

"I stopped letting things slide. When a woman was interrupted, I'd say, 'Let's hear her finish.' It's a small act, but it changes the room."

This aligns with Hewlett's (2019) call for sponsorship and allyship, particularly from those in power, to break gendered silos in advancement.

Organizational Advocacy: Embedding Equity

Several participants described how advocacy turned into policy reform. These ranged from structured mentorship programs to pay equity audits, standardized job descriptions, and diverse hiring panels. One HR executive recalled:

"We implemented a rule – no interview shortlist can be all-male. It's not perfect, but it forces us to look harder for overlooked talent."

Such practices reflect research on effective interventions. Kalev et al. (2006) emphasize that voluntary, internal accountability mechanisms (like task forces or peer-led audits) are more successful than top-down mandates.

Likewise, Seron et al. (2018) warn that superficial DEI rhetoric, without structural support, often triggers backlash or burnout.

Participants in the advocacy phase also understood the backlash dynamic – that women who advocate may be framed as "difficult" or "too political" (Rudman & Fairchild, 2004; Eagly & Heilman, 2016). One participant shared:

"I was told I'm becoming too 'passionate' about diversity. But I kept going because I saw the difference it made."

Their courage reflects a growing collective awareness that silence sustains the status quo. Advocacy is thus not just about amplifying voices but normalizing inclusion in everyday decisions – from product design to leadership evaluations. This normalization is increasingly digitally mediated, as algorithmic fairness, platform ethics, and AI inclusivity become part of leadership agendas (Cech, 2021; Brescoll, 2016).

Cultural Shift and the Long View

The most striking evidence of advocacy's success is the cultural shift described by participants. One manager shared:

"I remember when talking about gender bias was taboo. Now, even junior staff bring it up in meetings. It's like we finally gave people permission."

Such shifts point to a tipping point, where advocacy has reached critical mass (Kanter, 2018). Diversity becomes not just a side topic but part of the company's DNA. Still, as multiple participants noted, advocacy is never "done." One advocate cautioned:

"You don't beat bias once and for all. You stay vigilant. You keep pushing."

This sentiment reflects the maintenance stage in models of organizational change – where sustainability becomes the new goal (Bass & Riggio, 2006). The digital age both enables and demands this: rapid information flow, increased transparency, and social accountability mean that companies – and leaders – can no longer hide behind vague commitments.

5. CONCLUSION

This study explored how women in high-tech environments become aware of, interpret, and respond to gender bias – tracing a five-phase trajectory from **Denial** to **Advocacy**. Drawing from rich qualitative content, we found that participants navigated a deeply ingrained **meritocratic culture** that initially concealed inequalities behind a veneer of objectivity and fairness. As Cech and Blair-Loy (2010) explain, this **"meritocratic default"** not only frames individual effort as the sole pathway to success but also silences systemic critique. Many participants began their careers believing that "if you do the work, you'll get ahead," only to gradually recognize exclusion from projects, promotions, and informal networks that dictated advancement.

Each stage in the journey – **Denial, Recognition, Passive Awareness, Strategic Adaptation, and Advocacy** – reflected a meaningful shift in

participants' understanding of gendered dynamics. In the early phases, bias was minimized or internalized as personal inadequacy (Eagly & Heilman, 2016). Recognition often emerged after repeated micro-inequities or dissonant experiences that could no longer be dismissed. In Passive Awareness, a sense of helplessness often prevailed: participants knew bias existed but lacked tools or psychological safety to intervene. Strategic Adaptation marked a turning point, where participants began to apply data, networks, and practical adjustments to push back against unfair practices – aligning with Brescoll's (2016) insight that perception management and visibility can mitigate biased evaluations.

The final phase – **Advocacy** – was especially illuminating. It demonstrated how some participants transformed their understanding into **systemic action**, implementing structural interventions such as bias audits, interview reforms, and DEI task forces. These efforts echo the work of Kalev et al. (2006) on effective diversity practices, and Ibarra et al. (2013) on the need for inclusive leadership design. Importantly, advocacy was often **digitally mediated**. From Slack collectives to LinkedIn campaigns, the **digital transformation of the workplace** empowered individuals to amplify marginalized voices, crowdsource strategies, and hold leadership accountable in new and visible ways. As one participant noted:

"The real shift happened when we started comparing notes – on Slack, in side chats, on Google Docs. Suddenly, we weren't isolated anymore."

The study also confirmed a recurring barrier: the **ideological power of meritocracy**. Even as awareness grew, many participants felt pressure to avoid being labeled "difficult" or "overly political" – a reflection of the **backlash** dynamic described by Rudman and Fairchild (2004). In environments where gender bias is taboo to discuss, advocacy often requires strategic framing, strong allies, or organizational rank. Indeed, those who reached the advocacy stage often had to move beyond individual survival to embrace collective responsibility.

Our findings suggest that **bias awareness is not linear**, nor guaranteed. Many participants cycled between recognition and passivity, or between adaptation and frustration, depending on organizational culture, leadership support, and peer dynamics. Still, the trajectory we mapped reveals a **progressive shift** – from silence to visibility, from isolation to coalition, and from compliance to cultural transformation.

Transforming high-tech cultures requires more than simply increasing representation or issuing DEI statements. It demands disrupting the **illusion of neutrality** and reimagining leadership beyond the narrow, masculine-coded archetypes that still dominate the field (Eagly & Karau, 2002; Ridgeway, 2011). It requires leveraging digital tools not only for technical innovation but for **social change**, enabling transparency, shared learning, and collective voice.

Ultimately, this study underscores that change is possible – but only when awareness becomes action. Advocacy is not the end of the journey; it is the

beginning of a **new organizational consciousness**, one that challenges the status quo and strives for a workplace where inclusion is not an initiative, but a norm.

By grounding gender inclusion efforts in lived experiences and structural critique, we move closer to a **post-meritocratic future** – one that recognizes excellence not as the absence of difference, but as its full expression.

6. ACKNOWLEDGMENT

7. ABOUT THE AUTHOR

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INNOVATIVE POLICIES AND CHALLENGES IN ADVANCING SUSTAINABLE AFFORDALBE HOUSING IN THE EU

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Abstract
Current policy innovations and socio-technical factors influence the provision of sustainable, affordable housing in the European Union. The issue of rising cost burdens, overcrowding, housing shortages and environmental needs, all of which have important social and economic impacts on lower and middle-income groups, is of particular concern. This article examines why affordability remains an enduring challenge despite the EU's commitment to reducing environmental impacts and social inequalities. This article draws on a mixed qualitative and quantitative approach, policy analysis, existing academic literature, and EU-wide statistical data to capture current housing trends. The theoretical framework uses sustainability concepts (environmental, social and, economic) and affordability benchmarks to evaluate how policy innovations and construction practices affect housing. Preliminary results show that effective policy measures such as targeted subsidies, inclusive land-use planning and advanced construction technologies can improve both the cost-effectiveness and environmental performance of affordable housing. Initial findings suggest that collaboration among stakeholders, including local communities and private developers, improves the implementation and long-term viability of projects. The incorporation of sustainable construction practices has been demonstrated to reduce carbon emissions whilst also promoting social equity and community resilience. Comprehensive policy reforms that incorporate multi-stakeholder collaboration and ongoing monitoring of affordability and sustainability targets represent a potential mechanism for effecting meaningful change. Future research will expand the empirical dataset to include diverse urban and rural areas, and test innovative construction techniques and financing models to develop evidence-based affordable and sustainable housing strategies.
Keywords: affordable housing, sustainable development, European Union policy
JEL Classification: O21, Q56, R31

1. INTRODUCTION

The issue of affordable housing is a major challenge with extensive implications for the socio-economic well-being of communities around the world. In view of increasing urbanisation and stressed housing markets, there is an increasing urgency to ensure access to affordable, high-quality housing that is energy sustainable and climate neutral. The concept of affordable housing is

complex and multifaceted, encompassing a range of definitions and interpretations that vary by country and context. The essence of affordable housing is to provide access to appropriate housing for households without imposing an excessive financial burden, particularly on low-to-middle income households. In recent years, sustainability principles have been increasingly integrated into housing policy, reflecting the global commitment to sustainable development. This shift is reflected in the Sustainable Development Goals (SDGs) set out by the United Nations in 2015, which emphasise the need to make cities inclusive, safe, resilient, and sustainable (United Nations, 2015). The Digital Europe Programme is a programme funded by the European Union that was launched in 2021 and aims to support the integration of digital technologies in the economy, the population, and public administrations (European Commission, 2021a). The 2024 European Green Deal sets ambitious climate and sustainability targets, committing the construction industry to play a key role in reducing energy consumption and CO_2 emissions with two main goals for the construction industry: all new buildings should be zero-emission by 2030, and all existing buildings should be climate-neutral by 2050 (European Commission, 2019). This initiative signifies the necessity of aligning housing policy with broader sustainability goals, as outlined in the SDGs (Fei *et al.*, 2021).

The creation of sustainable and affordable housing is challenging due to the integration of sustainability principles into housing policy. The implementation of innovative technologies and practices has the potential to improve sustainability, but the provision of affordable housing remains a significant challenge. This is due to the fact that the demand for sustainability is not only limited by financial factors, but also by social demands (Moghayedi *et al.*, 2021). Innovative approaches, such as lean construction methods and the incorporation of energy-efficient designs, are fundamental to reduce costs while improving housing quality (Khan and Fang, 2020). In regard to climate change, it is acknowledged that housing design must evolve to ensure resilience (Rañeses *et al*., 2021; Ruíz, 2023). The importance of government policy in promoting sustainable housing is a critical factor in this context. The implementation of subsidies and incentives for sustainable technologies is recommended as a strategy to encourage the adoption of green practices in affordable housing (Rodríguez-Reyes and Cortés Lara, 2023). In addition to political frameworks, the involvement of the private sector and community stakeholders is crucial to the promotion of sustainable and affordable housing. Collaborative community participation in housing project planning and execution facilitates the generation of customised solutions aligning with the distinct requirements of residents (Reid, 2023). Innovative financing mechanisms, such as low-interest loans and grants for sustainable housing projects, have also been identified as a means of achieving greater investment in affordable housing (Veleva, 2021). Acknowledging the challenges posed by regulatory restrictions and financial constraints, which hinder the adoption of

sustainable practices in affordable housing, there is an urgent need for concerted efforts to navigate these barriers and promote the sustainable and affordable housing sector (Hilber and Schöni, 2022).

This article examines the complexity of affordable housing and sustainability, focusing on the strategies and initiatives in Europe. It analyses the definitions and challenges of affordable housing, the principles of sustainable architecture and environmentally friendly design, and the role of IT services in promoting energy efficiency in affordable housing. By analysing strategies employed in various European Union countries and their applicability to other EU member states, this article aims to provide a nuanced understanding of how countries and cities can effectively address the issue of affordable housing while also advancing the EU's stated sustainability goals. The article emphasises prospective methodologies, including the enhancement of financial models, the simplification of regulatory frameworks and the development of capacity for sustainable practices. This systematic approach is recognised as being paramount for achieving long-term affordability and sustainability in housing (Akinsulire *et al*., 2024).

2. BACKGROUND KNOWLEDGE
2.1 Defining affordable housing

The concept of affordable housing is predicated on the necessity of accommodating households whose financial resources are insufficient to secure appropriate housing in the open market without external assistance (Milligan *et al*., 2004). Discussions concerning the social acceptance of affordable housing, are often complicated by the inherent ambiguity of the term itself. There is no universally accepted definition of affordable housing, as the concept encompasses a range of housing types, rent or price structures, and resident income requirements. The evolution of the term "affordable housing" as a contemporary replacement for various synonymous terminologies referring to housing designated for individuals unable to afford market rates is of particular interest (Koebel *et al*., 2004). Consequently, affordable housing is universally understood as providing accommodation for households with low-to-middle incomes, allowing them to access suitable living conditions without excessive financial burden (Milligan *et al*., 2004). In recent years, the terminology "affordable housing" has increasingly replaced terms such as "public", "social", or "low-cost" housing (Gabriel *et al*., 2005).

The definition of affordable housing is not uniform, being defined in a variety of ways, the common theme of which is the recognition of the difficulties of affordable housing. Comprehending the underlying causes of the affordable housing crisis is as sophisticated as the establishment and quantification of the income requirements for eligibility. As evidenced by ongoing debates on affordability, numerous conceptual and methodological challenges become apparent from conflicting interpretations of the issue. Households with a single

adult, lone-parent, or family with adults and children are often confronted with difficulties in reconciling high housing costs with their limited income levels, employment opportunities, commuting expenses, healthcare needs, and other essential expenses (Gabriel *et al*., 2005). In response to these challenges, the Australian government has adopted a working definition of affordable housing. "Affordable housing is housing that is appropriate for the needs of a range of low-to-middle income households and priced so that low-to-middle incomes are able to meet their other essential basic living costs" (Milligan *et al*., 2007, p. 26). In the United Kingdom, affordable housing is understood to encompass both traditional social housing, whether publicly owned or managed by housing associations, and newly developed below-market-rate housing available for purchase or rental. For instance, in the London Plan, affordable housing is defined as "housing designed to meet the needs of households whose incomes are not sufficient to allow them to access decent and appropriate housing in their borough. Affordable housing comprises social housing, intermediate housing and in some cases, low-cost market housing" (MOL, 2004, p. 60). In Germany, affordable housing, colloquially referred to as social housing, refers to newly constructed residential properties funded through direct subsidies from federal, state, and local governments (BMWSB, 2025). The legal framework governing this sector is established by the Social Housing Promotion Act (WoFG), which outlines the principles for affordable housing construction and identifies target populations, specifically households unable to independently secure housing in the private market. The financial and legal obligations pertaining to the provision of affordable housing are allocated to the federal states, obliging them to conform to both federal and state-level legal provisions (BMWSB, 2025). The allocation of public funding ensures that newly constructed properties are designated as affordable housing, with regulatory oversight provided by the Housing Commitment Act (WoBindG). Occupancy of these units is subject to an eligibility commitment, whereby qualification is contingent upon obtaining a housing entitlement certificate (Wohnberechtigungsschein), issued by relevant authorities based on income criteria. Rent control mechanisms further regulate the pricing of subsidised units, with rates varying according to the size of the municipality, its geographic location, and property characteristics. In Romania, the state provides and subsidises affordable housing in accordance with the provisions of the Housing Act No. 114/1996. This form of accommodation is designated for individuals or families whose financial constraints preclude them from purchasing or renting private-market housing. The maximum rental cost for such units is set at 10% of the monthly net income of the tenant, with rent subsidies being calculated on the basis of household earnings from the previous twelve months. Any shortfall between the actual rental price and the government subsidy is covered by the budget of the local administratively territorial unit (Alpopi, Iacoboaea and Stănescu, 2014). Explicit statutory definitions of affordable

housing are in existence primarily in Estonia, Poland, and Romania, where municipal housing is allocated to the most economically disadvantaged households. Conversely, in Czech Republic and several Eastern European nations, no standardised definition of affordable housing has been formally established (Lux, 2003).

A comparative international perspective underscores the inherent complexity of defining affordable housing, highlighting the impossibility of formulating a definition that is universally applicable. Instead, the concept is shaped by the distinct political, legislative, and programme contexts of individual countries. The primary challenge lies in identifying the specific policy needs within each jurisdiction and developing targeted measures that effectively address affordable housing concerns. This process consists of several stages, including the assessment of the extent and characteristics of the issue, the monitoring of housing market trends, the provision of information for the development of policy, and the provision of guidance to professionals in the building and construction industry (Gabriel *et al.*, 2005).

2.2 The challenge of affordable housing

Across numerous countries worldwide, the provision of affordable housing is identified as a key policy priority, particularly in the context of housing costs rising more rapidly than overall inflation. A substantial proportion of the disposable income of low-income households, notably those headed by younger residents, is dedicated to housing expenses, resulting in a considerable financial imposition. In response to this challenge, many governments have implemented affordable housing programs, either on a nationwide basis or at the regional level, with the aim of providing subsidised accommodation for social groups whose housing needs are not met by the private market (Czischke and van Bortel, 2023; Hyde, 2022; Zheng *et al.*, 2020). Despite the implementation of these interventions, there remains a discrepancy between demand and current sustainable affordable housing provision. Between 2015 and 2024, rents in the EU increase by 13.3%. The general trend of rising housing costs observed in many industrialised countries since the 1950s is mainly driven by rising land values rather than construction costs. Demand for housing has continued to rise due to urbanisation, population growth and social and cultural change, while the supply of housing is limited in many areas. As a result, affordability issues have intensified, particularly in cities. In 2023, 10.6% of urban residents in the EU were classified as cost-burdened, paying more than 40% of their disposable income, compared with 7% in rural areas. The highest urban rates were observed in Greece (31%) and Denmark (23.3%), and the lowest in Cyprus (3.4%) and Croatia (3.5%). Rural congestion rates were similarly high in Greece (24.7%) and Luxembourg (22.1%), but minimal in Cyprus (0.7%) and Slovenia (2.5%). In some EU member states, such as Denmark, the gap between urban and rural areas

is significant, while in Bulgaria and Romania the rural areas are more overcrowded (Özdemir and Koukoufikis, 2025). People who have recently entered the private rented market have considerably higher cost-to-income ratios than those who have been renting for longer, indicating growing affordability pressures for newer entrants, including younger people and those in transition. The growing financial strain on European households is reflected in the UK housing sector. Years of undersupply have intensified the problem, leading to the proposal of a major reform to build 340,000 new homes a year, of which 145,000 should be affordable. Affordability remains an ignored component of this initiative, leaving most local authorities unable to meet the growing demand for affordable housing (Wilson and Barton, 2023). The new homes being built are typically unaffordable for those on low-to-middle incomes, contributing to the limited supply of affordable housing in England. A 20-year forecast by the charity Shelter suggests that an additional 3.1 million affordable homes will be needed over that period (Shelter England, 2019). Scotland faces similar challenges in providing affordable housing. A 2020 report jointly commissioned by Shelter, the Chartered Institute of Housing Scotland and the Scottish Federation of Housing Associations concluded that housing in Scotland has become unaffordable for a sizeable proportion of the population. In addition, the country's national housing programmes are delivering only half of the projected need. The report suggests that up to 60,000 affordable homes need to be built over five years to meet demand. In response, the Scottish Government has set a target of building at least 53,000 new affordable homes by 2026 and at least 10,600 dwellings per annum (Shelter Scotland, 2020). In the United States, federal government research has similarly highlighted the prevalence of severe housing problems. Survey data from 2023 show that the number of households with worst case housing needs increased from 8.48 million households in 2011 to 8.53 million in 2021. These households are characterised by exceptionally low incomes, severely inadequate housing conditions or rental costs exceeding 50% of their total income. In addition, only half of these households currently have access to affordable housing. These statistics highlight the inadequacy of public housing policies to adequately address the needs of low-income residents (U.S. Department of Housing and Urban Development, 2023). While the situations described here relate primarily to Europe and the United States, they represent only a small part of a global phenomenon. Other regions, including Honk Kong, New Zealand, Canada, Mexico, and India also report significant deficits in affordable housing (Cooper, 2024).

Affordable housing has become increasingly important, but the academic literature still lacks a consensus on its precise measurement or definition (Stigler, 1954). Historical attempts to conceptualise affordable housing date back to the nineteenth century, when researchers and policymakers recognised the need for more explicit measures. Stigler observed that these early efforts, both theoretical

and empirical, resembled a comedy of errors. A practical rule of thumb that emerged in the United States, "a week's wages for a month's rent", illustrates the longstanding preference for a simplifying measure of the relationship between income and housing costs. Similarly, Kenngott (1912) reported that at least twenty per cent of income was considered necessary for rent. These historical benchmarks anticipated the norms of the late twentieth century, which suggest that 25-30 per cent of income is the upper limit of affordable housing. These figures reflect assumptions about the average household without clarifying exactly which households are being referred to. Over time, empirical observations about what particular households spend on housing have often been transformed into prescriptive statements about what they "should" spend (Hulchanski, 1995). Within Europe, there is widespread agreement that affordable housing is under considerable pressure, but definitions of affordability vary between countries. Consequently, the definition of affordable housing requires consideration of the social, economic, and environmental factors that contribute to household well-being. Although it is generally accepted that households paying more than 30 per cent of their gross income for adequate and decent housing face affordability problems, this definition is not universally accepted (Pittini, 2012).

The complexity of affordability issues emphasises that no single measure can adequately capture their nature and extent. It is therefore imperative to identify the specific policy objectives related to these issues and to develop measures tailored to individual national contexts. Such approaches would allow more accurate assessments of housing market developments and better inform further policy development (Gabriel *et al*., 2005).

2.3 Definition of sustainable housing

Sustainable housing is a sophisticated concept that integrates environmental, economic, and social dimensions to create living spaces that are efficient and resilient, as well as equitable and culturally responsive. This definition aligns with the broader framework of sustainable development, which emphasises the necessity of balancing human needs with the integrity of the natural environment. The concept of sustainable housing encompasses ecological, social, and economic dimensions with the objective of formulating housing solutions that address the present requirements without compromising the needs of future generations (Moghayedi *et al*., 2021; Gbadegesin and Marais, 2020). Research indicates that sustainability considerations have often been overlooked in the case of affordable housing due to restrictive policies, cost concerns, and limited incentives for real estate developers (Moghayedi *et al*., 2021). In consequence, housing of substandard quality, with high long-term maintenance costs, remains prevalent, particularly in regions facing challenges such as rapid population growth, environmental disasters, and socio-political instabilities (Aliyari, 2024). According to the Brundtland Commission's definition, sustainability is defined as

the ability to meet present needs without compromising the ability of future generations to do the same (United Nations, 1987). In the context of housing, this mandate spans three interrelated dimensions: environmental, social, and economic (Aliyari, 2024). Environmentally sustainable housing is defined by the minimisation of the ecological footprint through the implementation of energy-efficient technologies, materials reuse (upcycling), and green construction practices that reduce waste (Akinlolu *et al*., 2022; Rekhi and Stern, 2022). Social sustainability is dependent on inclusive housing designs and policies that encourage cohesive communities, enhance social participation, and ensure the availability of affordable units in new developmental projects. From an economic perspective, sustainability in housing refers to cost-effectiveness in construction, reduced life-cycle expenditures for residents as in energy costs, and flexible building models such as modular housing and 3D printing to promote long-term affordability (Jacobus, 2015; Wakely and Riley, 2011).

Despite policy efforts in certain contexts, the widespread integration of sustainable building principles remains limited, often due to a combination of prohibitive initial costs and insufficient financial incentives (Du Plessis, 2007; Moghayedi *et al*., 2020). The construction of sustainable housing is dependent on an integrated model that balances multifunctional development, green building technologies and community-oriented designs (Friedmann, 2023). This comprehensive strategy has the potential to stimulate local economies, reduce carbon emissions, and enhance social well-being (Gbadegesin and Marais, 2020). Despite this potential, obstacles persist, including the absence of comprehensive policy frameworks, the excessive cost of sustainable technologies, and a shortage of skilled labour (Chan and Adabre, 2021). The reduction of the ecological footprint is a fundamental objective of sustainable housing, incorporating elements such as energy efficiency, the utilisation of sustainable materials, and the integration of innovative building technologies (Rañeses *et al*., 2021). The concept of sustainable housing is characterised by features such as zero-energy or low-carbon designs, resource-efficient usage, and socio-cultural considerations that align with the lifestyles of residents (Sanei *et al*., 2022). The viability of sustainable development in the affordable housing sector is dependent upon economic factors. The utilisation of green building materials and energy-efficient designs is instrumental in reducing long-term expenses for residents (Akinsulire *et al*., 2024). Sustainable housing models are characterised by a commitment to social equity, emphasising inclusivity and the common good (Ruiz, 2023). Resilient housing policies that prioritise safe land use and the adoption of alternative energy sources are imperative in fostering sustainable environments that can accommodate diverse populations. The integration of social equity principles into housing policy ensures that all members of the community have access to safe, affordable, and sustainable housing options. Incorporating sustainable housing policies into urban planning facilitates sustainable urban

development through community interaction and resource sharing, thereby promoting social equity and sense of community (Aliyari, 2024). There is a need to adopt lean construction methods alongside energy-efficient designs, particularly in the context of affordable housing, to meet broader sustainability targets across Europe (Khan and Fang, 2020). Technological innovation has been established as fundamental to the realisation of sustainable and affordable housing (Moghayedi *et al*., 2021). The integration of novel technologies in housing design has been demonstrated to improve the health and well-being of residents while maintaining affordability, emphasising the increasing necessity for technology-driven solutions in an era of rapid urbanisation and growing environmental concerns. The strategic allocation of subsidies to sustainable technologies offers a potential catalyst for the development of energy-efficient housing solutions, contingent upon the effective design of such measures to minimise inefficiencies. The effective implementation of sustainable housing initiatives, which must consider environmental, economic, and social imperatives, depends on the existence of policy frameworks that have been thought through well, and which are set by the EU (Rodríguez-Reyes and Cortés Lara, 2023).

2.4 Sustainable architecture and green design

Since the 1960s, concerns about resource exhaustion, pollution and ecological destruction have led to the development of design principles that prioritise environmental sustainability. This shift has led to the emergence of green and sustainable design, which aims to integrate human activities with the natural environment and establish a socially beneficial relationship. According to Yuan and Tang (2021), the aim is to enable the continued use of resources, improve ecological conditions and enhance the quality of life.

Sustainable architecture, alternatively designated "green architecture", seeks to minimise the negative environmental impacts of buildings by utilising materials, energy, and space in a considered manner. This approach encompasses ecological conservation at every stage of design and construction, with the fundamental objective being to meet present-day needs without compromising the capacity of future generations to fulfil their own requirements. This framework is grounded in the core principles of sustainable development, including economic viability, environmental preservation, and social well-being. The social dimension of sustainability is of significant importance, as it highlights the necessity of ensuring justice for both current and future societies, as well as across diverse regions. It also has the capacity to encompass the safeguarding and promotion of cultural and geographical diversity, in addition to the ability to make decisions that recognise the interdependence among social, cultural, economic, and ecological phenomena (Chansomsak, 2008; Throsby, 2001).

The principles of sustainable architecture can be categorised into five key categories:

1. Energy use efficiency: The sustainable architecture approach aims to reduce reliance on artificial energy sources by optimising natural lighting and ventilation. Strategies include the use of solar energy, natural air conditioning methods, and rainwater harvesting. These measures minimise energy consumption and are adapted to specific climate needs.

2. Land use efficiency: Land use efficiency is enhanced by maximising green spaces and reducing building footprints. Approaches such as roof gardens, vertical gardens, and integrating vegetation into building design help to maintain ecological balance. Existing vegetation is preserved, and open spaces are included to encourage biodiversity.

3. Material use efficiency: This principal advocates for the use of sustainable, renewable, and recyclable materials in construction. Employing waste materials and repurposed building components reduces waste generation. The prioritisation of abundant and low-impact materials is aimed at minimising environmental harm.

4. Utilisation of innovative technologies and materials: Sustainable architecture is defined by its integration of technological advancements to leverage renewable energy resources, such as wind and solar power, and its exploration of novel sustainable materials, exemplified by rapidly renewable and environmentally sustainable options like bamboo, with the objective of reducing the ecological impact of construction and operation.

5. Waste management: The efficient management of waste is integral to sustainable architecture, as evidenced by the implementation of strategies such as the treatment and recycling of domestic waste, the use of biodegradable materials, and the integration of innovative waste decomposition systems. These initiatives are designed to minimise the overall environmental impact (Syam *et al*., 2023).

Contemporary sustainable architecture emphasises the revitalisation of green spaces, such as farmland and forests, in conjunction with the creation of comfortable built environments. In contrast to earlier architectural approaches, which frequently result in substantial environmental sacrifices, modern methods prioritise the reduction of ecological burdens through natural energy utilisation and long-term resource sustainability (Gissen, 2003). This increasing emphasis on sustainability is primarily attributable to the expanding human population and the resultant pressure on finite natural resources. Within the discipline of architectural planning and design, specific strategies have been identified which function as guiding principles in the realisation of sustainable development. For instance, in the context of a coastal region, a building might incorporate design elements reflective of the local marine environment, such as wave-like forms and wind-driven patterns. The optimal placement of openings and the maximisation of natural lighting are further enabled by the use of diagrams charting the solar trajectory, thereby enhancing energy efficiency. The integration of local cultural and environmental features into architectural design has been demonstrated to

facilitate the authentic representation of regional identity and the harmonisation of buildings with their surroundings (Syam *et al*., 2023). Green design, also entitled "design for the environment", is a comprehensive set of methodologies focused on minimising a product's negative environmental impact while optimising resource efficiency throughout its lifecycle (Yuan and Tang, 2021). The conventional 3R-model (reduce, reuse, recycle) has expanded into a 10R-model, encompassing reduce, reuse, recycle, renew, refurbish, repair, remanufacture, replace, refine, and remove. Multifaceted in nature, green design seeks to reduce environmental harm by minimising waste, conserving natural resources, and curbing pollution. Achieving reduced dependence on fossil fuels and the promotion of sustainable energy usage is achieved through energy-efficient measures, such as the employment of renewable energy sources and the enhancement of building insulation and ventilation. The long-term benefits of these strategies include substantial cost savings by optimising resource utilisation and reducing operational costs, thereby increasing the economic viability of sustainable projects. The use of non-toxic materials, adequate ventilation, and natural light, collectively improve indoor environmental quality, promoting healthier and more comfortable spaces. Green design is an essential element of sustainable development, aiming to reconcile economic growth, environmental protection, and social equity. Green design has the capacity to drive innovation in materials, technologies, and processes across various industries, thereby establishing new standards for sustainable practices and facilitating their broader implementation (Faludi, 2017; McMahon and Bhamra, 2015).

As environmental consciousness grows, regulatory pressures and consumer preferences for sustainable products and buildings are increasing. Green design fulfils an instrumental role in addressing these demands, ensuring compliance with environmental regulations, and aligning with market expectations for ecologically sustainable solutions (Yuan and Tang, 2021).

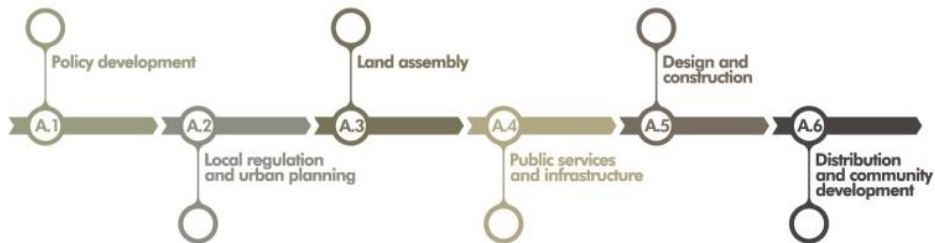## 2.5 The value chain for affordable housing supply

Providing affordable housing is a complex challenge that exists on a European and global scale, with inefficiencies present at every stage of the housing industry value chain, which in turn have a negative impact on the performance of the entire supply system (World Economic Forum, 2019). These challenges put the efforts of the United Nations to ensure universal access to adequate, safe, and affordable housing by 2030 at risk (United Nations, 2015). Despite a substantial body of literature addressing construction-related inefficiencies, for example workflow planning, collaborative working practices, and sustainability measures, there remains a lack of holistic analyses that specifically focus on affordable housing. Therefore, it is crucial to detect and document inefficiencies, as well as to communicate this information throughout the value chain to ensure that stakeholders are aware of the approaches that can

be taken to consider these areas for intervention and the mitigation measures to be implemented (Reid, 2023).

The term "value chain" refers to the network of actors whose collaboration and interaction enables the production of goods and services for a specific consumer group (Gereffi *et al*., 2006; Peppard and Rylander, 2006). In this article, the focus is on residential real estate for low-income groups. An examination of construction value chains reveals marked tendencies towards waste and inefficiency, highlighting the potential for logistical optimisation (Lönngren *et al*., 2010). It is evident from several studies that there have been attempts to ascertain the challenges hindering the supply of construction value chains and propose innovative approaches to reshape current practices. These studies have addressed topics such as the promotion of collaborative working environments, the improvement of workflow planning and project management, the introduction of modern construction techniques, the implementation of information technology, the initiation of health and safety reforms, the promotion of corporate social responsibility and the incorporation of principles of environmental sustainability into building design and construction, such as reusing building materials and adopting green building technologies (Akintoye *et al*., 2000; Eriksson *et al*., 2008; Hoonakker *et al*., 2010; Stewart *et al*., 2004; Häkkinen *et al*., 2011; Martek *et al*., 2019; Persson *et al*., 2015). Despite the focus on inefficiencies in the construction supply chain, there is a lack of research that provides a comprehensive understanding of the sector-specific barriers to the design and construction of affordable housing. Reid's study aims to broaden the scope of the investigation to provide a comprehensive overview of the systemic challenges facing the affordable housing sector (Reid, 2023). In accordance with the recommendations of the World Economic Forum (2019), Reid examines the multi-stage process of providing affordable housing from a six value-adding chain perspective (see Figure 1). The process starts with the formulation of national housing policy; whereby central governments set the required levels of affordable housing provision and introduce supportive programmes designed to achieve these targets. These national policies guide the multitude of stakeholders involved in the affordable housing value chain, while also forming the urban planning frameworks through which local authorities coordinate affordable housing activities at the urban and regional level. In accordance with federal and state regulations, local authorities work with private sector companies to identify and allocate appropriate land for affordable housing initiatives. Once the property acquisition has been completed, utilities and public service providers construct the public infrastructure and community assets needed to support and supplement affordable housing developments. These assets include utilities, transportation networks, educational facilities, green space, and community, health, and social services. housing developers then collaborate with their contracted partners to design and construct affordable housing, which is managed, maintained, and

operated by independent, non-profit organisations dedicated to providing housing for the population. These organisations are typically part of the housing association sector.

Figure 1. The supply side of the affordable housing value chain
Source: (Reid, 2023, p. 5)

3.   METHODOLOGY

This article provides a qualitative framework, with the aim of collecting and analysing relevant data and information on sustainable and affordable housing and the possibility of new construction, to determine the state of housing in the context of political opportunities and challenges and to analyse models for sustainable housing that are applicable to the EU. The research focusses on the comparison of the statistical data available in the Eurostat database available statistical data on the construction industry and the stock and procurement of affordable housing for the European countries. During the documentation phase, specialised articles are consulted to familiarise with the importance of the European Union, the sustainability and sustainable affordable housing models, and to choose an approach that best serves the purpose of the study. This article extensively references previous research studies, academic articles, and publications by various authors to gather background information, theoretical frameworks, and empirical evidence related to sustainable affordable housing, EU policy, affordable housing policies in the European countries, and the impact of the SDGs on the housing industry across Europe. Qualitative analysis of policies, programmes, and housing trends in the European Union are conducted, examining the differences in legislative frameworks, government policies, and the impact on housing provision and affordability. Quantitative data is provided to support the discussion on various aspects of housing policies, policy programmes, and on the need of a resilient and sustainable construction industry, challenges in implementing sustainable policy demands, and opportunities for a more sustainable and technologically advanced construction sector for affordable housing.

These derived methods contribute to a more nuanced understanding of the complex dynamics at EU member state housing sectors that depend on affordable

and sustainable housing. They enable a socio-economic, legislative, and market-focused examination of the factors that influence housing policy and the housing industry. The study concentrates on the issue of housing. It is recommended that this study be expanded to include other types of projects, such as infrastructure or technology development, which would also contribute to the development of affordable and sustainable housing.

4.   ANALYSIS
4.1   Policy innovations in sustainable affordable housing

The integration of sustainable development principles into affordable housing policies has gained significant emphasis in addressing European housing challenges while ensuring environmental sustainability and social equity.

The European Green Deal, initiated by the European Commission in 2019 (European Commission, 2019), signifies a critical political initiative aimed at fostering a climate-neutral, pollution-free, sustainable, circular, and inclusive economic model. This initiative constitutes the foundational element of a novel industrial strategy for Europe (European Commission, 2020), which advocates for the conscientious creation and production of materials and products. The overarching objectives of the European Green Deal can be summarised as follows: firstly, to minimise risks to human health and the environment; secondly, to enhance the safe utilisation of products without any adverse impacts on human health and the environment; thirdly, to augment the potential for reuse and recycling; and fourthly, to incorporate safety enhancements and extend the product's lifespan. A critical component of the European Green Deal is the promotion of affordable housing, a concept which is congruent with various sustainability initiatives. The European Green Deal emphasises the necessity for innovative and sustainable housing solutions that not only meet the growing demand for affordable housing but also meet environmental standards and contribute to social justice. It emphasises the pressing need to improve energy efficiency and affordability in the building sector, given that buildings account for 40% of energy consumption and renovation rates remain inadequate to meet climate and energy targets. Moreover, fifty million consumers in the EU are confronted with energy poverty. In response to these challenges, the EU has proposed a significant initiative termed the "renovation wave", focusing on both public and private buildings. The primary objectives of this initiative are to increase renovation rates, reduce energy costs, and mitigate emissions. Key elements of the strategy include the European Commission's strict enforcement of building energy performance legislation and the exploration of the inclusion from buildings in European emissions trading. They conduct a review of the Construction Products Regulation, with a view to harmonising new and renovated buildings with the principles of the circular economy, digitalisation, and climate-proofing (European Parliament, 2011). A renovation initiative involves

stakeholders such as construction companies, architects, and local authorities, with a view to addressing renovation barriers. The initiative has also been designed to remove regulatory barriers, with a particular focus on the renovation of affordable housing, whilst improving energy efficiency (European Commission, 2019).

Another innovative instrument is InvestEU (European Parliament, 2021a), which focuses on the leveraging of public funds to attract private investment, a strategy that is particularly relevant in the context of affordable housing, where traditional financing models often prove insufficient. A key component of this innovative instrument is the European Fund for Strategic Investments (EFSI), which provides a €33.5 billion EU guarantee and attracts an additional €500 billion in investments between 2015 and 2020, including funding for affordable housing. The European Commission introduced InvestEU in 2018, with the objective of mobilising €1 trillion in investment between 2021 and 2027, supported by a €75 billion guarantee. Within InvestEU, €3.6 billion has been allocated to social investment and skills development, while €20 billion is earmarked for sustainable infrastructure projects, including housing renovation initiatives aimed at enhancing energy efficiency. By providing guarantees and risk-sharing mechanisms, InvestEU encourages private sector participation in projects that might otherwise be deemed too risky or unprofitable. The integration of innovative financing solutions is beneficial for the development of sustainable and affordable housing projects that meet environmental standards and social needs (Akinsulire *et al*., 2024; Reid, 2023). InvestEU acknowledges the community participation and stakeholder engagement as being essential to ensure economic viability and social integration (Winston, 2021; Rodríguez-Reyes and Cortés Lara, 2023). The alignment of InvestEU with the European Green Deal is evidence of its commitment to sustainability, as it supports investment in green technologies and sustainable practices. These are essential to achieving climate neutrality by 2050 (Moghayedi *et al*., 2021). Recent years have seen the affordable housing sector within the EU contend with considerable challenges, primarily marked by an escalating demand for housing in urban areas and a concurrent decline in investment (Palimariciuc, 2021). The demand for affordable housing has increased dramatically, with homelessness in the EU rising by 70% over the past decade, affecting approximately 700,000 individuals on any given night (Fondation Abbé Pierre, 2020). Housing cost overburden, defined as the proportion of disposable income allocated to housing that exceeds 40%, predominantly affects lower-income groups. A comparative analysis reveals that 35.4% of low-to-middle income households experience financial strain, in contrast to 9.4% of total households. The period between 2010 and 2019 saw housing cost burdens worsen for lower-income families (+1.7%), while the rest of the population experienced a decline (-6.3%), thereby underscoring market polarisation (Eurostat, 2025a). Additionally, energy poverty remains a concern,

with 18.2% of poorer households struggling to maintain adequate indoor temperatures (Eurostat, 2025b). Disparities in housing quality persist, as evidenced by the higher prevalence of overcrowding (29.1%) and the absence of essential infrastructure, such as indoor toilets, among lower income households (Eurostat, 2025c). On the supply side, public investment in affordable housing has declined by 27.8% between 2008 and 2018, decreasing from €29 billion to €21 billion (Eurostat, 2025d). The EU faces an annual investment gap of approximately €57 billion, which further accelerates the deterioration of the existing housing stock. High land prices, a shift in the perception of housing as an investment rather than a necessity, and rising construction costs deter private investors due to the low returns on investment. In addition, national disparities in housing-related public expenditure remain evident, with France and Ireland dedicating nearly 1% of GDP, while ten other member states contribute close to 0% (Omic, 2017).

The task force on affordable and decent housing solutions of the European Policy Centre (EPC) has formulated a set of recommendations for the optimised implementation of InvestEU, with the objective of guiding the EU institutions and member states in directing investments towards those most in need. The recommendations are designed to address the imbalance between supply and demand in the affordable housing sector, which is presented as a critical opportunity by InvestEU. EU member states must enhance public support for housing through innovative financial instruments that are capable of mitigating investment risks. It is recommended that member states enhance public support for housing through innovative financial instruments that mitigate investment risks, while the European Commission should provide clear regulatory guidelines (Palimariciuc, 2021). The Urban Agenda for the EU (UAEU) constitutes the EU's main voluntary commitment to the implementation of the United Nations (UN) New Urban Agenda (NUA) (European Commission, 2021b). The UAEU was established through the Treaty of Amsterdam in 2016, forming a platform to support the UN 2030 Agenda for Sustainable Development, particularly in advancing SDG 11. The objective is to design cities and settlements that are inclusive, safe, resilient, and sustainable (United Nations, 2015). The primary objective of the UAEU is to optimise the implementation and coherence of current policies, legislation and instruments relating to urban development. Rather than initiating new regulations, the UAEU functions as an informal framework that influences the design and revision of EU regulations, thereby ensuring greater responsiveness to urban needs, practices, and responsibilities. A key objective is to identify and eliminate potential administrative obstacles while minimising the administrative burden on city authorities. The UAEU seeks to achieve this by improving access to and integration of traditional and innovative sources of financing for urban areas, including funding from the EFSI. It does not advocate for an increase in EU funding or the creation of new financial allocations for urban

authorities. Instead, it focuses on making more effective use of existing funding mechanisms and on drawing lessons from EU policies and instruments, including EU cohesion policy. The UAEU's objectives also include the improvement of knowledge on urban affairs by means of the promotion of the collection of data, the exchange of good practices and the establishment of policymaking based upon evidence. Reliable data is of critical relevance in order to facilitate an understanding of the diverse structures and tasks of urban authorities and the development of tailored solutions to urban challenges. At national level, knowledge about the development of urban areas is fragmented and successful experiences are under-utilised. To address this, the UAEU is promoting large-scale, networked, and open data initiatives, while ensuring compliance with EU data protection rules and the reuse of public sector information. In answer to these challenges, a total of fourteen partnerships have been established to date, with a focus on a range of issues, including culture and cultural heritage, energy transition, housing, the integration of migrants and refugees, sustainable land use and nature-based solutions, and urban mobility (European Commission, 2025a).

The Affordable Housing Initiative (AHI) constitutes a further essential element of the European Commission's Renovation Strategy, the overarching objective of which is to promote energy-efficient building renovations and improvement in quality of life (European Commission, 2025b). The strategy aims to double the renovation rate in the EU by removing barriers to sustainable renovation, promoting reuse and recycling, and ensuring that thirty-five million buildings are renovated by 2030. The AHI is an integral component of the strategy, with the specific objective of ensuring that affordable housing facilities benefit from the proposed efforts. This is achieved by establishing one hundred flagship renovation and new development areas, employing a smart neighbourhood approach that prioritises energy efficiency, quality of life and innovation. These areas are designed to provide replicable blueprints for future projects. The AHI combines energy-efficient renovations with sustainable design principles, ensuring that buildings remain affordable, accessible, and liveable, while contributing to a just green transition. It seeks to mobilise cross-sectoral partnerships and link them with local actors such as social economy organisations, small and medium-sized enterprises (SMEs) in the construction and renewable energy sectors, local authorities, housing associations, investors and civil society organisations, as well as promoting the introduction of innovative renovation processes, including circular and modular construction, renewable energy generation and community engagement models to empower local populations (European Commission, 2025b). The AHI is built on the foundations laid by previous EU housing policies, including the UAEU (European Commission, 2021b), the Committee of Regions' opinions on housing, the European Economic and Social Committee's opinions on housing, the European Parliament's resolution on maximising the energy efficiency of EU buildings, the European Parliament's

resolution on decent and affordable housing for all (European Parliament, 2021b) and the European Commission recommendation on ensuring a fair transition towards climate neutrality (European Commission, 2021c).

These policy innovations are adapted within affordable housing frameworks by balancing financial constraints with performance objectives, often achieved through the use of locally sourced materials and cost-effective technologies (Akinsulire, 2024).

4.2 Challenges in implementing a resilient design of affordable housing

The implementation of resilient, affordable housing design confronts a triad of economic, social, and environmental challenges. As urban populations continue to exhibit growth, there is an increasing demand for affordable housing, requiring innovative solutions that also prioritise sustainability and resilience to climate change. Barriers to the integration of sustainable practices into affordable housing policy include financial constraints, building and regulatory hurdles, and the demand for community engagement.

A significant challenge to the implementation of resilient, affordable housing is the financial viability of new construction projects. Many affordable housing initiatives experience difficulties in securing adequate financing, a factor which is imperative for the integration of sustainable design features and technologies. The application of sustainable practices in affordable housing necessitates an initial investment that is not feasible with the constrained budgets typically available for affordable housing projects (Akinsulire *et al*., 2024). The inherent challenge with traditional financing models is their inefficiency in accommodating the costs associated with affordable housing projects. These projects are characterised by low investment returns and extended payback periods. Private investors are known to be reluctant to engage with this sector due to concerns over risk and limited profitability. Public investment in affordable housing has decreased significantly. It has halved since 2001 (Housing Europe, 2023). There is also a risk that reliance on public funding and subsidies may create a dependency that limits the adoption of sustainable practices and innovation (Reid, 2023). The financial constraints experienced by developers are further pronounced by the rising costs of building materials, raw materials, and labour, which can discourage the implementation of sustainable housing construction options (Hilber and Schöni, 2022).

Regulatory frameworks pose significant barriers to the implementation of resilient design in affordable housing. Many existing development plans and building codes are not aligned with innovative construction methods or sustainable materials, thus hindering the introduction of resilient housing construction concepts (Khan and Fang, 2020). Policy reforms are required to support sustainable practices in the affordable housing sector. The implementation of affordable, resilient housing is often hindered by outdated regulations and

complex administrative procedures. The lack of harmonised building regulations and energy performance standards across EU member states leads to discrepancies in the application of resilient construction principles (Khan and Fang, 2020). Current regulations often fail to encourage the use of energy-efficient construction methods and materials. The "renovation wave" is expected to enforce more stringent legislation on the energy efficiency of buildings. But the question of how to integrate the principles of the circular economy, digitalisation and climate-proofing into housing policy is yet to be answered (European Commission, 2019). Moreover, the bureaucratic processes associated with the procurement of permits and approvals have the potential to be both extensive and intricate, thereby discouraging investors and developers from pursuing sustainable options (Ruíz and Mack-Vergara, 2023). Numerous urban authorities encounter administrative impediments that prevent them from accessing EU structural and investment funds in an effective manner (Palimariciuc, 2021). This regulatory inertia has the capacity to inhibit creativity and limit the potential for transformative change in affordable housing design. Community engagement is another critical aspect influencing the success of projects for resilient, affordable housing (Reid, 2023). The lack of participation of local communities in the design and planning phase can result in developments that fail to meet the actual needs of residents (Winston, 2021). Participation by residents in decision-making processes remains limited, with many affordable housing initiatives lacking mechanisms for meaningful stakeholder engagement. The incorporation of residents in the design process has demonstrated an improvement in the social sensitivity of housing projects (Reid, 2023). Participation of low-income communities is often constrained by barriers, including limited access to information, financial education, and decision-making power in housing projects. AHI emphasises community involvement, but the practical implementation of this is inconsistent across geographies. Strategies such as co-housing models, participatory budgeting, and local energy cooperatives have the potential to increase resilience by empowering residents to take ownership of their communities.

The consequences of climate change are confronting planners and construction companies with massive difficulties, as evidenced by the increase and intensification of extreme weather events, including heavy rain and windstorms (Ruíz and Mack-Vergara, 2023). These events require the development of strategies and materials that can withstand the climatic conditions, a process that can be prohibitively expensive, especially in the context of affordable housing projects for low-income groups. This creates a paradoxical situation where the population demographics most exposed to the impacts of climate change are also the least able to access resilient housing solutions.

4.3 Opportunities for advancement

The integration of sustainable practices in new affordable housing construction has been demonstrated to improve quality of life for individuals, whilst simultaneously promoting economic growth and social equity (Fei *et al*., 2021). The construction sector aligns its projects with global needs and creates business solutions that contribute to the common good by implementing the SDGs. Entrepreneurship promotion proves to be an influential factor in encouraging sustainable lifestyles and practices. Grants, soft loans, and business start-ups have been shown to provide financial and advisory support for large-scale companies (Veleva, 2021) and also enable SMEs to innovate and implement sustainable practices. This support is paramount for encouraging an entrepreneurial ecosystem that prioritises sustainability, especially in construction and housing, where innovative solutions can lead to noteworthy progress in sustainability metrics. Partnerships between government agencies and non-profit organisations can raise awareness and promote initiatives for waste prevention and resource efficiency, which further contributes to the SDGs (Veleva, 2021). Building standards such as Passive House and Leadership in Environment and Energy Design (LEED) not only promote energy efficiency, but also contribute to a healthier living environment, thus improving the overall quality of life for residents. In addition, affordable housing programmes have a positive impact on social equity and economic development. Technological innovations contribute to greater sustainability (Moghayedi *et al*., 2023). By prioritising the needs and preferences of residents, housing initiatives encourage greater community engagement and satisfaction, improving the overall impact of sustainable housing projects.

5. DISCUSSION

The study shows that the implementation of policies such as subsidies for sustainable technologies, inclusive land-use planning, and advanced construction methods, combined with sustainable raw materials, can improve the cost-effectiveness and environmental performance of affordable housing. These factors enable the integration of energy-efficient and climate-resilient construction methods, which contributes to a reduction in $CO2$ emissions and long-term housing costs. The findings emphasise the value of stakeholder engagement, particularly the involvement of local communities, developers, and governmental authorities, in ensuring the resilience and sustainability of affordable housing. This cooperation helps to integrate local contexts and needs, enrich project design with contributions from residents, and strengthen social integration. The study reveals that, despite EU-wide commitments, affordability remains an issue due to financial and regulatory barriers. Restrictive planning frameworks, under–investment in affordable housing and rising land prices in cities are limiting the adoption of sustainable practices in new construction and renovations. These

findings emphasise the need for clarity and consistency in regulations across EU member states, as well as improved financing tools, particularly those that incentivise private sector participation. The findings of this study are consistent with those of other research emphasising the importance of technological and policy innovations in addressing the affordability-sustainability gap. Previous studies have identified strategies such as lean construction methods and renewable energy integration as potentially effective solutions to reduce operating costs for low-income residents while also reducing emissions. Similarly, previous research suggests that the introduction of innovative technologies must be accompanied by effective urban governance frameworks, implying a mutual reinforcement of incentives, regulations, and community-oriented planning. The generalisability of the findings is limited by the following factors. Firstly, the research is restricted to European Union countries and is based on a combination of secondary qualitative and quantitative data. This focus may result in the context-specific variables present in non-EU countries being disregarded, where national regulations, sociopolitical dynamics and funding opportunities may differ. Secondly, the study relies on existing policy frameworks and preliminary data for arguments, rather than large-scale empirical measurements, so the findings may reflect policy intentions rather than concrete outcomes. Thirdly, while the article discusses promising technological advances, including 3D printing, modular housing, and energy-efficient refurbishment, it does not provide detailed cost-benefit analyses for each individual innovation. Certain ambiguous outcomes concerning the most efficacious financing models and construction methodologies are plausibly attributable to the marked variations in EU member state conditions. The success rate of affordable housing projects is influenced by a variety of factors, including differing degrees of municipal autonomy, divergent housing market conditions illustrated by growing urban centres versus depopulated rural areas, and fluctuations in construction costs. This article further emphasises the importance of collaboration among stakeholders, yet the evidence on what type of partnership (public-private, community-driven, or cross-regional) achieves the best results is inconclusive. The realisation of sustainable and affordable housing can be achieved through policy innovations and targeted measures that consider local conditions, the regulatory environment and community engagement.

6. CONCLUSION AND FUTURE PROSPECTS

This article provides an analysis of the factors contributing to affordable housing challenges across the European Union, in the context of the EU's commitments to reducing environmental impacts and social inequalities. The article methodically examines EU policy instruments related to affordable and sustainable housing. The analysis of data and the evaluation of existing research confirm the finding that policy innovations, such as targeted subsidies and inclusive land-use planning, can improve the cost-effectiveness and

environmental performance of affordable housing subsidies. The study suggests that the combination of advanced construction technologies and stakeholder collaboration can lead to substantial reductions in carbon emissions, while concurrently strengthening community resilience. Despite the presence of ambitious EU-wide commitments, the research identifies regulatory and financial barriers at the local level, emphasising the necessity for more integrated policy frameworks and dedicated funding mechanisms. The findings of the study indicate that further research should be directed towards the exploration of specific technical solutions, such as the use of circular building materials and modular construction methods, with a focus on underserved urban and rural areas. Long-term studies are also recommended to assess the impact of diverse financing models, such as community-based revolving funds or green bonds, on affordability throughout the entire life cycle of buildings. Research into community engagement strategies can contribute to identifying effective practices for ensuring local acceptance and equitable outcomes. The findings emphasise the importance of a comprehensive strategy that integrates policy, finance, and community empowerment to achieve progress in the provision of affordable and sustainable housing. Addressing these issues is important well beyond academic circles. Ensuring that people across Europe have access to high-quality, energy-efficient homes can help strengthen economic resilience, reduce social inequalities, and mitigate climate change.

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WHY DO YOU USE TIKTOK? DEVELOPING MEASUREMENT SCALES FOR PLEASURE AND FUNCTIONALITY FROM GENERATION Z PERSPECTIVE

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Abstract
Nowadays, TikTok dominates the social media world, particularly among Generation Z. Being on TikTok involves not only receiving content, but also creating it, sharing and engaging with people from across the world. On TikTok, individuals feel happy, curious, informed and relaxed as the platform offers the opportunity to romanticize life and escape the real world. On the other hand, TikTok is the driving source for Generation Z to talk about real life problems. This study aims to investigate the determinants that describe the motives to use TikTok by Generation Z and to develop measurement scales for motives to use TikTok by Generation Z users. Data were collected from 2589 respondents from Generation Z. The questionnaire included a scale which consists of 36 items describing various motives to use TikTok. Integrating the SPSS software for data analysis, two important variables were identified as main motives for TikTok usage: pleasure and functionality. Understanding the motives behind its usage became increasingly important, as the findings can serve as a source of information for influencers and brands in building trust among Generation Z users.
Keywords: Gen Z, TikTok, social media, motivation, short – form videos, pleasure.
JEL Classification: M3, M31, M37.

1. INTRODUCTION

Generation Z lives in a digital era that is in continuous development. While always being connected through social media, Gen Z are the ones who might become the new gold mines for platforms. One of these platforms is TikTok – an app based on short-form video format that helps content creators and influencers to be more visible. Based on its algorithm and user-friendly interface, TikTok has revolutionized how Generation Z consumes and produces digital content. Moreover, Gen Z are not just passive consumers, but also active participants who seek social recognition through the platform's features. This study aims to analyse the motives that drive Generation Z to spend time on TikTok and engage with different types of content. Using empirical measurement scales, the study identifies the key factors that influence young users to entertain and educate themselves through TikTok. Through this approach, the research contributes to a clearer understanding of the online behaviour of Generation Z and their social needs.

2. LITERATURE REVIEW

In this section, we discuss about TikTok and Gen Z, and we dive into more details regarding their motives to use TikTok. Further, we try to understand why Gen Z spends hours scrolling through this app, emphasizing the benefits that it can bring to individuals.

2.1 Motives to use TikTok

Before presenting the reasons behind TikTok usage, it is essential to first provide an overview of the application and its functionality. TikTok is a platform that gives the possibility to create, share, and watch video content of different formats (D'Souza, 2022). The app was developed in 2016 under the name ByteDance which later became the TikTok we know nowadays. Investopedia demographic research shows that of one billion global users, 43% of them are Gen Z, with an age range of 18–24 years (Investopedia, 2022). It is important to mention that TikTok is not only for entertainment, but also for creative purposes. As the platform started to gain popularity during the pandemic, more and more individuals migrated from Instagram and developed their TikTok accounts till they had millions of followers. Why? Because being on TikTok means being more seen, appreciated, watched, and shared (The Fix, 2020). Moreover, the app is more convenient to use than YouTube or other social platforms, due to its short–form content (Falgoust et al., 2022). In general terms, the preference for TikTok is given by the benefits that it has, in comparison to other social media. Unlike other apps, TikTok users can share their stories and engage with other people's lives (Scherr et al., 2021). Also, if we compare with Facebook or Instagram, TikTokers can express themselves not only through photos, but also through voice and emotions, which attracts more

engagement and trustworthiness (Dong et al., 2023). In other words, we can say that the motives behind the use of TikTok depend on the type of user: is he a player or a watcher? Players are the ones who not just watch but also create short videos on TikTok, while watchers just scroll and engage without producing any content (Yang, 2016). But both categories use TikTok first to escape the real world. Other than that, studies highlighted reasons like self–presentation, trends, addiction, information, and recognition (Xie et al., 2024). On the other hand, engaging in TikTok is also a form of time–killing and inspiration–seeking (Jung et al., 2025). Moreover, studies show that the app is positively correlated with addiction and dependency symptoms, as it was found out that Gen Z watches 68 videos on average daily (Pew Research Center, 2019).

2.2 Generation Z

iGen, Gen Tech, Click Gen, or Online Generation—these are the terms we use when we try to identify Generation Z—a bunch of post-millennials that is specifically known as connected or computerized, always in change, and always clicking (Dolot, 2018). But who is this Gen Z in reality? Born after 1996, people from this generation are already technology natives, used having access to instant information and communication (Cilliers, 2017). Being constantly connected, what makes the Gen Z one of the most prominent ones compared to past generations (Lu et al., 2018), as they are the truth and freedom seekers. Gen Z individuals value authenticity, and they are not afraid to be open on social platforms (Francis et al., 2018). That is why, they are more likely to develop strong online bonds not only with people from the same group, but also with influencers and brands (Kotler et al., 2021). They try new experiences and share them, which makes this generation one of the most essential markets for products and services. From a similar perspective, Gen Z individuals prefer the screen instead of paper, and the internet instead of books (Salleh et al., 2017). Literature describes the Gen Z generation through four characteristics: (1) innovation, (2) convenience, (3) security, and (4) escapism (Wood, 2013). In this order of ideas, marketplaces represent an important tool for them to always be on track, to have all products in one place, and with considerable discounts. On the other hand, Gen Z is also called the "do-it-yourself" generation, as they tend to have a greater preference for entrepreneurship, due to the economic crises they have grown up in (Singh et al., 2016). Compared to the past generations, Gen Z has a different approach to tasks, putting more emphasis on flexibility and fast and open-minded solutions.

2.3 Generation Z on TikTok

TikTok is a platform that gives the opportunity to express yourself, and that is what Generation Z is all about. They like to communicate, to be seen, and to share their opinions, frustrations, feelings, and achievements in the online world,

as this gives them the feeling of being heard and understood. In this order of ideas, the motives of Generation Z to stay on TikTok are rather hedonistic than practical (Rahayu et al., 2025). The desire to experience and to find new sources of joy, motivates this generation to embrace a new user-friendly platform like TikTok (Zips et al., 2023). In other words, Gen Z's natural interest in everything that is new in the digital world, motivates them to explore more and TikTok's content is perfect for this scenario. Curiosity has an important role in engagement, as young users are in a constant need of novelty (Salasac et al., 2022). Another key factor that influences the motives of Gen Z to browse on TikTok is the short-form content that the application offers, as the preferences in terms of time have changed nowadays (Turner, 2015). This generation has lots of contrasts: from powerful and edgy, to feminine and soft, and TikTok is the best place where they can be themselves (Stahl et al., 2022). Besides self-expression and popularity hunting, the reason why Gen Z watches so much content on TikTok is because they are seeking authenticity. They follow influencers who have the same values, or they fight for the same causes (Francis et al., 2018). Another role of the platform is for activism or spreading important information on different social causes (Zips et al., 2023). Ultimately, the explosion of information and its widespread presence on TikTok have attracted many users who now primarily use this platform as a source of news instead of solely for entertainment (Hai Bui, 2022).

3. METHOD

3.1 Research design

This study relies on quantitative research. We collected data from Generation Z individuals using a questionnaire-based online survey. The purpose of this paper is to identify latent variables describing the motives to use TikTok by Gen Z users. In this case, the objectives of the research are the following:

(1) To identify the determinants that describe the motives to use TikTok by Generation Z.

(2) To configure measurement scales for motives to use TikTok by Generation Z users.

3.2 Participants

As specified in the previous section, the participants of this study were Generation Z TikTok users on whom we used an age filter.

3.3 Questionnaire design

The online questionnaire was adapted, modified, and enriched with the existing scales from the literature (Gu et al., 2022; Scherr et al., 2021). The

initial scale consists of a pool of 36 items describing various motives to use TikTok as observable variables. For each item, participants were asked to choose the grade for the level of agreement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The items list was previously pretested.

3.4 Data collection and data analysis

Data collection implied the use of the snowball technique. A number of 2589 responses were retained for further analyses, as these users corresponded to the Generation Z age interval (between 13 and 28 years old). We employed the SPSS software for descriptive and inferential statistics.

4. RESULTS

4.1 Sample description

The age range of participants was 15 to 28 years (mean M = 21.25, SD = 2.39). Most participants identified as female (62.3%), while 64.2% live in urban areas. Almost 70% reported low and very low income (less than 3000 RON/month). Almost 50% (46.5%) admit to spending between 2–3 hours/day using TikTok.

4.2 Identifying the determinants that describe the motives to use TikTok by Generation Z users

We conducted Principal Components method under SPSS for the exploratory factor analysis. The analysis initially includes 36 items.

The first output revealed 4 factors with EigenValue > 1 to explain 65.7% of the total variance. The items loading below 0.3 were excluded from the analysis. As such, we conducted several analyses, excluding one item at a time, until we reached a model with two dimensions. 18 items were removed, and 18 items were retained in the final dimensions. KMO score is 0.946, which is greater than 0.7, indicating a good model. The sig corresponding to Barllett's Test of Sphericity is lower than 0.5, indicating there is at least one correlation between the initial variables. The final two dimensions explain 68.11% of the total variance.

The following tables present the items grouped as factors. Table 1 presents the dimension Pleasure consisting of 11 items, and explains almost 48.48% of the total variance.

Table 4.1. Pleasure

Item	Item load
I use TikTok from smartphone because it gives me a good mood	0.844
I use TikTok from smartphone because it relaxes me	0.844
I use TikTok from smartphone because it is entertaining	0.841
I use TikTok from smartphone because it creates a good vibe	0.835
I use TikTok from smartphone because it gives the chance to take a break from activities	0.782
I use TikTok from smartphone because the time passes more faster, even when I am bored	0.771
I use TikTok from smartphone because there are a lot of new things	0.759
I use TikTok from smartphone because it makes me happy again when I feel sad	0.753
I use TikTok from smartphone because in this way, the time passes faster	0.737
I use TikTok from smartphone because this way I can forget the unpleasant situations from work, school or life	0.692
I use TikTok from smartphone because I can inform myself	0.671

Based on the questionnaire results from SPSS analysis

Table 2 presents the Functionality dimension consisting of 7 items, and explains almost 19.62% of the total variance.

Table 4.2. Functionality

Item	Item load
I use TikTok from smartphone because I can record and post videos that attracts other's interest	0.905
I use TikTok from smartphone because I can film and post videos through which I can show my accomplishments	0.896
I use TikTok from smartphone because I can	0.875

become popular	
I use TikTok from smartphone because I can obtain reactions from others (likes, hearts etc.) by filming and posting videos	0.871
I use TikTok from smartphone because I like to film videos	0.828
I use TikTok from smartphone because the reactions I get on my videos (likes, hearts etc.) are an accomplishment for me	0.807
I use TikTok from smartphone because filming for TikTok is very easy	0.706

Based on the questionnaire results from SPSS analysis

4.3 Configuring measurement scales for Generation Z users' motives to use TikTok

The internal consistency of the scale assessing the latent variable Pleasure, measured with Cronbach-alpha, is 0.941, indicating the scale has excellent internal consistency. The internal consistency of the scale assessing the latent variable Functionality, measured with Cronbach-alpha, is 0.942, indicating this scale has also excellent internal consistency. As such, both scales can be used to assess the Pleasure and Functionality of a certain social media network, from Generation Z users' perspective.

5. DISCUSSIONS AND CONCLUSIONS

In this study we analyzed the relationship between Generation Z and TikTok usage, with the focus on what motivates them to navigate most of their time on this app. The results show that, mostly, Gen Z uses TikTok for two main motives: pleasure and functionality. Peeps from Generation Z are scrolling TikTok first to unwind, to get themselves in a good mood and to escape from the real-life problems. Previous research has reached similar results, highlighting that the significant motivation for using TikTok stays in the emotional relaxation (Omar et al., 2020). On the other hand, responses like 'I can inform myself', show that informational content is also valued by Gen Z and that it motivates them enough to stay on TikTok for hours. Through items like 'I can record and post videos that attract other's interest' or 'I like to film videos'; we can see the importance of the functionality of the platform for Generation Z. Moreover, TikTok became a place of self-presentation, identity construction, and social approval. This generation is mostly a player rather than just a watcher, because they are more motivated by the chance to be seen, to receive likes and to show their achievements - a desire for social recognition (Shao, 2009). To conclude, helping users to relax and escape the real world and enabling them to create and share content for visibility are two dimensions that motivate Gen Z to browse on TikTok. These dimensions can help marketers, content creators, and, most

importantly, brands to build stronger relationships with their customers from a generation that is always connected—Generation Z. To get more insight into the relationship between TikTok and Generation Z, we suggest a platform-based comparison study, in which we compare TikTok with other short-form content applications such as Instagram or YouTube. Also, another important aspect to consider is the analysis of motives to use TikTok from other generations' perspectives and how they vary from one generation to the next, such as Gen Alpha. Such efforts would further clarify the role of TikTok in shaping the behavior and social image of today's generations.

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THE USE OF SOCIAL MEDIA TECHNOLOGIES IN PRE-UNIVERSITY EDUCATION: A LITERATURE REVIEW

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Abstract
Regardless of personal preferences, social media technologies have become an integral part of contemporary life, rapidly emerging as primary channels of communication and information for a significant portion of the global population though the accuracy of such information is not always guaranteed. Younger generations, commonly referred to as Generation Z and the succeeding Generation Alpha, are exposed to and proficient in digital technologies and social media platforms from an increasingly early age.
The current educational system struggles to keep pace with the accelerated advancement of technology and the unprecedented speed at which information is disseminated. In the present era, access to information is virtually unrestricted, no longer confined to books or other traditional print media.
This article serves as a preliminary exploration within a broader research initiative aimed at integrating social media technologies into the pre-university educational environment. It seeks to provide a comprehensive review of existing international literature on the subject, analyzing key findings and evaluating their implications for the academic context.
Keywords: Social media, education, new generations, non-formal education.
JEL Classification: A19, A21, A22, A20, A31

1. INTRODUCTION

The use of new technologies, particularly social media, is ubiquitous in students' everyday lives. Free or inexpensive apps sold via app stores have facilitated the birth of a social media-centric society that influences how we communicate, educate, and learn.

The term 'social media' or 'social networks' refers to a computer-based technology that makes it possible to share concepts, ideas, and knowledge via online groups and networks (Chen Yeong Sheng, 2022). The use of these social networks within the education system has gained momentum with the onset of the COVID19 pandemic.

Both educators and students actively utilized social media platforms to maintain communication, exchange information, and collaborate remotely. This interaction often occurred through dedicated social media groups or via private messaging features inherent to these platforms. In some instances, teachers conducted online lessons using tools such as Facebook Messenger, leveraging its accessibility and familiarity.

As reported by DataReportal.com, by April 2025, the global number of social media users had exceeded 5.31 billion. On average, individuals spent around 2 hours and 40 minutes daily engaging with these platforms. Among them, Facebook held the leading position with approximately 3.07 billion active users, followed by YouTube and WhatsApp, which also boasted substantial user bases.

Numerous studies have investigated the various motivations driving social media usage. Gaining insight into these motivations can provide valuable guidance for integrating social networks into educational contexts. For example, approximately 22.4% of users primarily use these platforms to discuss topics and exchange ideas. For these individuals, incorporating structured debate formats into educational social media groups could foster a more engaging and stimulating learning experience. (https://datareportal.com/social-media-users accessed on 21.05.2025).

Figure 1. Key Statistics on Social Media Usage According to DataReportal.com
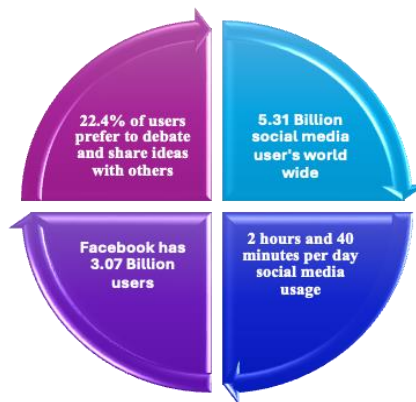
Source: (DataReportal.com)

This study aims to explore the compatibility between social media platforms and educational environments, with particular emphasis on how this relationship has been addressed in previous academic research. To accomplish this objective, the article is structured into three major sections. The first section

provides a focused literature review on the global digital transformation of education systems, highlighting key trends and challenges. The second section presents a bibliometric analysis, conducted using data extracted from the Scopus database. The analysis was carried out with the support of VOS viewer; a software tool designed for constructing and visualizing bibliometric networks. VOS viewer enables the mapping of co-authorship relationships, citation patterns, and the co-occurrence of keywords, offering insights into the intellectual structure and thematic evolution of the field. The third and final section synthesizes the results of the analysis and discusses the main conclusions, emphasizing the implications for educational policy, teaching practices, and future research directions.

2. LITERATURE REVIEW

Cannon highlights significant challenges students faced during the sudden shift to online learning, including unstable internet connections, difficulties adapting to new digital platforms without adequate support, and limited access to necessary technology. These obstacles were especially pronounced in under-resourced institutions and affected student engagement and performance. Additionally, lack of familiarity with online tools created further barriers to participation.

Jin (2023) highlights key technical obstacles encountered by preservice teachers during online instruction in early childhood education amid the pandemic. Frequent disruptions caused by unstable internet connections hindered clear communication and made it difficult to assess children's engagement and learning progress during Zoom sessions. The limited visual field fooften restricted to children's faces or upper bodies further reduced the ability to observe interactions and respond with timely pedagogical support.

Preservice teachers also noted difficulties in determining when to intervene effectively due to the restricted view of children's activities. Additionally, the need for family members to provide technological support, such as recording or supplying devices, introduced both logistical and financial constraints, particularly in households with limited digital resources.

These challenges, closely connected to earlier discussions on digital equity and platform use, underscore the crucial role of adequate technological infrastructure in supporting meaningful online learning experiences for young children (Jin, 2023).

Understanding these challenges is crucial for contextualizing the later adoption of accessible platforms like WhatsApp and Zoom, as well as the role of social media in education. The following sections explore how these technologies have helped overcome communication barriers, support collaboration, and foster student agency in digital learning environments. (Cannon et al. 2022)

Building on the challenges of digital access and engagement, Childs and Taylor emphasize the critical role of social media within future research directions focused on school and district investments in digital communication. They argue that allocating resources to digital platforms, including social media, is essential for developing robust communication infrastructures. These platforms serve multiple functions, such as supporting student recruitment, enhancing marketing efforts, and facilitating learning needs that became especially apparent during the COVID-19 pandemic. This perspective highlights the importance of strategically integrating social media into educational policies to enhance communication efficiency and support educational processes in digital contexts (Childs and Taylor, 2022).

Agnew states that the use of digital platforms such as WhatsApp and Zoom within the synchronous hybrid approach brings multiple benefits to the process of observation and feedback in education. These technologies facilitate real-time communication between tutors, allowing for the quick clarification of observations and the immediate exchange of opinions during lessons, which contributes to more accurate and timely evaluation.

They also support professional collaboration by giving tutors, including those with less experience, the opportunity to learn from one another through the rapid exchange of messages and visual materials. Even in technically limited conditions, these tools enable more nuanced and comprehensive observations.

Furthermore, their use reduces the risk of missing essential information and offers increased flexibility, allowing tutors to participate remotely and support the educational process even in isolated areas. As a result, feedback becomes more collaborative, faster, and more effective, contributing to the high-quality training of future teachers. (Agnew et al., 2024)

Building on the discussion regarding the integration of digital technologies in educational contexts, the author extends the analysis to the role of social media, framing it as a critical space for student agency and ethical-political identity formation. Social media platforms are conceptualized as decentralized, rhizomatic environments that enable learners to navigate beyond the constraints of formal educational structures. Within these digital spaces, students are not only consumers of information but also active participants in constructing alternative narratives, resisting dominant neoliberal and securitized discourses that often shape the educational landscape.

Through their engagement with social media, students gain access to diverse political discourses and develop practices of critique that challenge the boundaries of sanctioned knowledge. This participatory engagement fosters a sense of self-efficacy and cultivates what the author describes as a posthuman subjectivity one that is fluid, adaptive, and responsive to the shifting demands of a technologically mediated society. Social media thus becomes a site for both personal and collective redefinition, enabling learners to experiment with new

forms of identity and resistance that are often inaccessible within traditional classroom settings.

Nevertheless, this potential is not without limitations. The institutional framing of social media as a source of risk, misinformation, or distraction contributes to a marginalization of digital activism within schools. Educational policies and the rhetoric of school authorities frequently position these forms of expression as threats to institutional order rather than as legitimate modes of civic engagement. As a result, students' efforts to mobilize or assert their voices through digital means are often delegitimized or constrained, revealing the tensions between emerging forms of digital agency and the regulatory frameworks of formal education. (Barnard, 2024)

Expanding the discussion on digital tools in education, Boer and Asino emphasize the central role of instant messaging applications in maintaining communication and educational continuity during times of disruption. WhatsApp, in particular, emerged as a widely adopted platform in the pre-tertiary education sector throughout the pandemic. It was employed extensively for organizing class- and subject-based groups, sharing study materials, exchanging messages and feedback, and fostering collaboration among teachers, students, and parents.

The authors highlight that the platform's widespread use made it a natural and effective channel for communication during crisis conditions. Its accessibility, familiarity, and ease of use contributed to sustained engagement from both students and their families, even in the absence of formal classroom settings. Despite these benefits, they also note that unequal access to smartphones and reliable internet connectivity posed significant barriers, limiting the platform's inclusiveness. (Boer and Asino, 2022)

Boer and Asino argue that while WhatsApp provided a flexible and pragmatic solution for educational communication under restrictive conditions, its heavy reliance also underscored deeper issues of digital inequality. They advocate for complementary strategies that can address disparities in access and ensure that all students are included in remote or hybrid learning environments. In this context, WhatsApp is positioned not merely as a communication tool, but as a key component of a broader digital infrastructure that must be critically examined and supported by equitable educational policies. (Boer and Asino, 2022)

Huber et al. (2022) emphasize the pivotal role that digital tools played in sustaining education during the COVID-19 pandemic. As the crisis unfolded, the use and availability of remote learning technologies expanded significantly, marked by a growing reliance on platforms such as MS Teams and Moodle for instructional delivery. This shift reflects an increased normalization of digital learning environments within educational systems.

However, the authors also note that technical challenges such as insufficient equipment and unreliable internet access remained major obstacles. While tools

like email, learning platforms, phone calls, and video conferencing were widely used for educational purposes, their effectiveness was closely tied to the level of technological infrastructure available to students, parents, and educators. The findings highlight that although digital tools became essential for remote instruction, disparities in access and technological readiness significantly influenced their impact. (Huber et al., 2022)

Within the broader landscape of digital integration in education, Hultman and Bergh (2024) examine the role of Facebook as an informal space for professional development and peer exchange among educators and other educational stakeholders. The platform is characterized as an accessible environment where members of the educational community can share experiences, build support networks, and engage in collaborative dialogue often functioning as a "digital conversation room."

However, the authors also point to inherent challenges in this setting. The informal and sometimes chaotic nature of discussions, particularly in the absence of effective moderation or clear professional purpose, can diminish the quality of engagement. Comparative studies further indicate that, unlike formal deliberative platforms, Facebook-based forums tend to prioritize inclusivity and informal expression over structured, rational discourse potentially limiting their capacity for in-depth, democratic dialogue. (Hultman and Bergh, 2024)

This use of Facebook aligns with the previously discussed digital tools, illustrating both the collaborative potential and the structural limitations of social platforms in supporting sustained, professional educational conversations.

In continuity with the broader discourse on digital transformation in education, Liu and Yushchik (2024) examine the integration of artificial intelligence (AI) as a catalyst for enhancing learning experiences and instructional efficiency. AI enables individualized learning by adapting educational content to students' specific needs and automating routine teaching tasks, which allows educators to allocate more time to research and professional growth.

The authors also emphasize AI's role in increasing content accessibility, supporting self-directed learning, and offering customized tools for emotional regulation and character development. Nonetheless, they identify key challenges such as insufficient infrastructure, gaps in digital literacy, and educators' difficulties in adopting emerging technologies.

This perspective aligns with previous analyses of digital tools, underscoring that while AI holds substantial promise for reshaping education, its impact depends on equitable access and systemic preparedness. (Liu and Yushchik, 2024)

3. METHODOLOGY

In the context of this research, the Clarivate Web of Science Core Collection served as the primary source of bibliographic data, due to its comprehensive coverage of high-impact, peer-reviewed academic publications

across disciplines. The selection of this database ensured the methodological consistency and academic credibility of the study.

The initial stage of the bibliometric process involved the formulation of a targeted list of keywords, which were identified based on the central themes of the research and are visually represented in Fig. 2. These keywords were strategically selected to capture a wide range of publications addressing the intersection between social media and education, including terms related to digital transformation, online learning environments, and educational technology.

Applying these keywords as search parameters within the Web of Science interface yielded an initial dataset consisting of 183,233 publications. This large corpus reflects the growing scholarly interest in the field, but also required further refinement to ensure thematic focus and analytical feasibility.

Subsequent filtering phases involved the application of additional inclusion and exclusion criteria such as publication language, document type (e.g., articles, conference papers, reviews), and relevance based on title and abstract content. These steps were essential in narrowing the dataset to a more manageable and coherent sample, which could then be subjected to bibliometric mapping and qualitative interpretation in the later stages of the research.

Figure 2. Initial Keyword Set Used for the First-Stage Filtering of Publications in the Web of Science Database
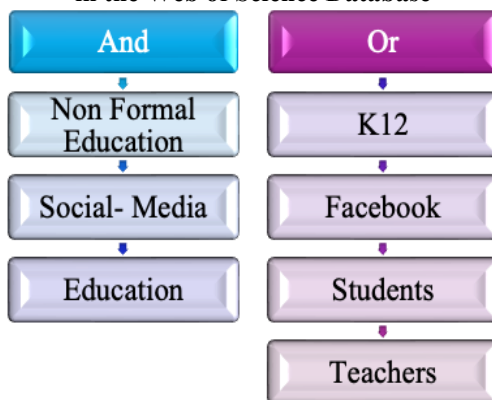
Source: (own processing)

The subsequent phase of the filtering process focused on selecting only open access journal articles, in order to ensure the accessibility and transparency of the sources included in the study. This criterion was applied to facilitate the reproducibility of results and to align the analysis with the principles of open science. By restricting the dataset to publications that are freely available to the public, the total number of relevant records was further reduced to 7,1313 open access articles, which formed the final sample for bibliometric mapping and qualitative assessment.

Following the open access refinement, an additional temporal filter was applied to further narrow the dataset. Specifically, only publications released between the years 2022 and 2025 were retained, in order to capture the most recent developments, trends, and research directions in the field. This time-based selection reflects the dynamic nature of educational technologies and social media integration, particularly in the post-pandemic context. As a result of this temporal filtering, the dataset was adjusted to include 30,774 articles, which represent the most up-to-date scholarly contributions relevant to the scope of this study.

An additional and essential stage in the data refinement process involved narrowing the selection strictly to publications categorized as journal articles. This decision was made to enhance the consistency and scholarly quality of the final dataset, by excluding other types of documents such as conference papers, book sections, editorials, and review articles, which may follow different peer-review standards or have different academic purposes. After applying this document-type filter, the dataset was further reduced to a total of 29,160 records, representing peer-reviewed journal articles that met all previously established criteria and were considered suitable for the bibliometric and qualitative phases of the research.

To ensure linguistic consistency and to facilitate accurate interpretation during the analysis phase, a final language-based filter was applied. Specifically, the dataset was restricted to publications written in English, given that English is the dominant language of international academic communication and the primary language of most indexed databases. This filtering step was crucial for ensuring both the accessibility of content and the comparability of results. After limiting the selection to English-language articles, the dataset was refined to a total of 27,567 publications, which formed the final body of literature subjected to bibliometric visualization and thematic analysis.

The next phase of the filtering process involved refining the selection by research discipline, concentrating specifically on the fields of education and educational research. This criterion narrowed the dataset to a total of 9,330 scholarly articles relevant to these subject areas.

Fig. 3 presents the geographic distribution of the articles according to their country of origin. Due to the extensive number of publications identified, the scope of the analysis was limited to a targeted group of representative countries within the Americas and Europe. This deliberate focus reduced the dataset to 5,994 articles, allowing for a more manageable and regionally relevant examination of the research output.

The next phase of the filtering process was based on a more specific categorization at the meso-level citation topic, concentrating exclusively on the fields of education and educational research. By applying this refined criterion, the dataset was significantly reduced, leaving a focused collection of 2,347

articles. This subset represents publications closely aligned with the targeted thematic area, enabling a more precise and relevant analysis moving forward.

The next phase of the filtering process involved selecting articles based on the journals in which they were published. Despite earlier filtering steps, some articles unrelated to the primary focus on educational research particularly those from medical fields or specific faculties remained within the dataset. To ensure greater thematic relevance, an additional filtering criterion was applied, restricting the dataset to articles published exclusively in journals with a clear focus on education. This refinement resulted in a concentrated corpus of 489 articles.

Figure 3. Geographical Distribution of Selected Articles Across Key Countries
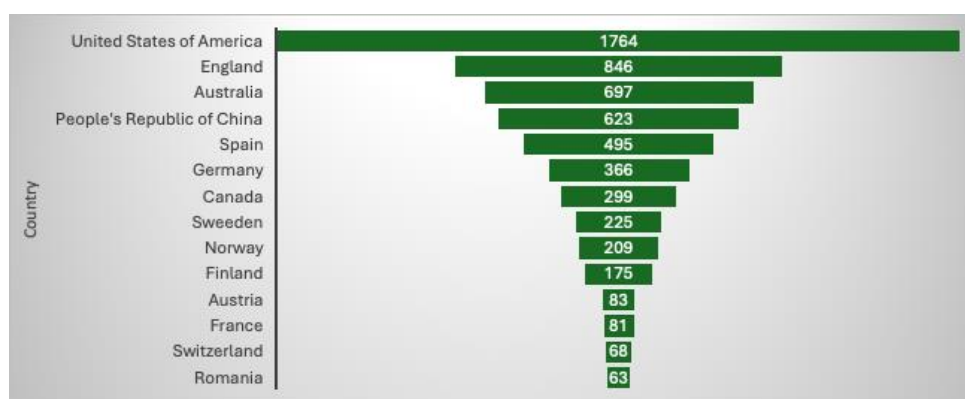
Among these, the journal Education Sciences contributed the highest number of articles, totaling 163. This was followed by Frontiers in Education with 139 articles, and Cogent Education, which accounted for 45 articles. Other significant journals included Education and Information Technologies with 32 articles and Teaching and Teacher Education with 28 articles. Additionally, Australian Education Researcher and Scandinavian Journal of Educational Research each provided 22 articles, while Online Learning contributed 21 articles. The dataset also included 12 articles from Educational Review and 5 articles from the Oxford Review of Education. This journal-level filtering was essential in refining the dataset to ensure that subsequent analyses focused exclusively on scholarship highly pertinent to educational research.

The final stage of the database filtering process involved restricting the selection to articles available under free-to-read access. This criterion further narrowed the dataset, resulting in a total of 149 articles eligible for analysis.

The concluding step in the filtering process involved the use of Zotero, a reference management software, which proved instrumental in retrieving full-text PDF documents that were embedded within the bibliographic references of the initially selected articles. This approach allowed for the systematic extraction

of otherwise inaccessible sources, thereby enriching the dataset with comprehensive materials crucial for subsequent in-depth analysis. By leveraging Zotero's capabilities, we ensured a more thorough and efficient collection of relevant literature beyond the limitations of initial database access.

Subsequent to the application of this final filtering procedure, the corpus was refined to a total of 35 articles. These selected publications are now slated for meticulous manual examination to enable an in-depth qualitative analysis, ensuring a comprehensive understanding of the thematic content and methodological approaches within the scope of the study.

4. RESULTS AND DISCUSSIONS BASED ON THE BIBLIOMETRIC ANALYSIS

Bibliometric research is a method of investigating academic literature and publications by means of a quantitative analysis of the bibliographic references included therein. This method is based on the principle that the more referenced a work is, the more influence it has in the development of its field of research. Bibliometric studies can be used to assess the scientific impact of an author, a publication or an institution, as well as to identify current research trends and directions. This method is very useful in the field of social sciences, political science, economics, and any field where academic research is carried out. It can help identify research trends, find the most important publications, and determine the impact of a research paper. On the other hand, clusters are groups of similar objects or entities and are used in data analysis to identify patterns and trends. Bibliometric research and clusters are often used in conjunction to assess the impact of research in a field, to identify affinities between researchers and their publications, or to identify research trends in a specific field. In this manner, these two instruments can provide a deeper and more detailed understanding of research activity and the environment in which it operates.

The map of associated terms was created upon processing the information on the Web of Science website as shown in fig. 4. The keywords included in the analysis make up the nodes, which are displayed in the figure below according to their contribution. While some keywords are strongly associated (short distance between nodes), others are weakly connected (long distance between nodes). (Waltman, L. VOS viewer Manual)

Figure 4. Visualization of Keyword Associations in Educational Research
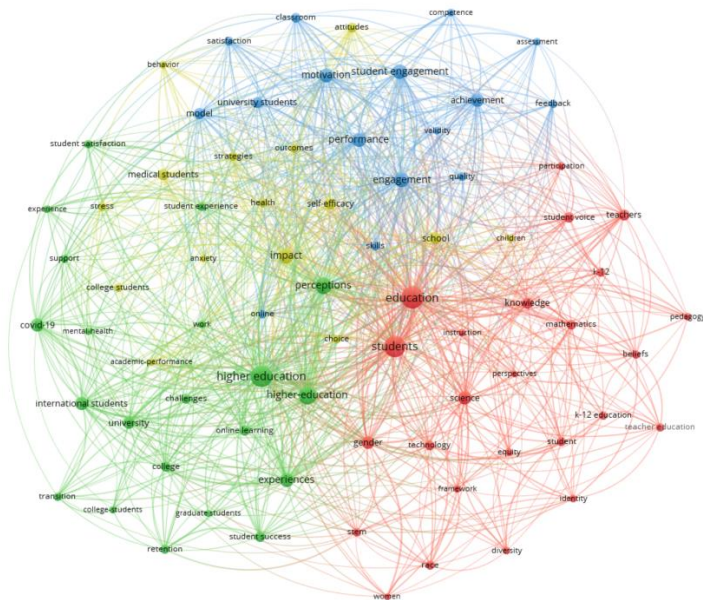
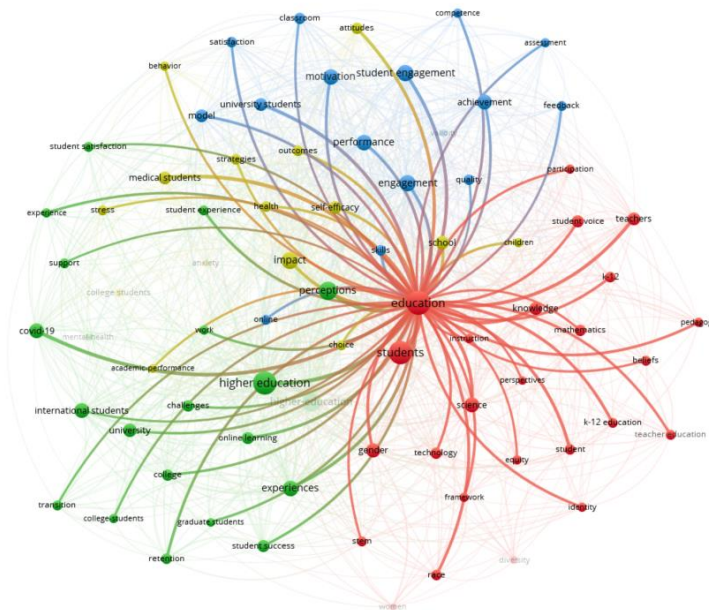Source: (own processing based on Web of Science Data)

The analysis conducted using VOS viewer resulted in the identification of four distinct clusters, which collectively comprise 77 unique keywords. These clusters represent coherent thematic groups within the dataset, highlighting areas of concentrated research focus. By organizing the keywords into these clusters, the software provides valuable insights into the underlying structure of the academic field, illustrating how related concepts and topics are interconnected through their frequency of co-occurrence.

The education-related cluster encompasses a range of interlinked concepts that reflect key research priorities within the field, particularly in the context of recent global challenges. Central to this cluster are terms such as knowledge, education, COVID-19, online learning, K-12 education, engagement, health, and self-efficacy. These interconnected keywords point to an evolving scholarly focus that bridges traditional educational themes with emerging issues brought about by the pandemic and the digital transformation of learning environments.

The inclusion of COVID-19 signals the significant impact of the global health crisis on educational systems, prompting researchers to investigate how teaching and learning practices adapted during periods of disruption. Online learning and K-12 education are frequently studied in this context, highlighting the shift toward remote instruction and its implications for younger learners.

These terms reflect a growing interest in the accessibility, effectiveness, and equity of digital education during times of crisis.

Figure 5. Connections Within Cluster 1: Education

Source: (own processing based on Web of Science Data)

The prominence of engagement, self-efficacy, and health indicates a concern with the psychological and emotional dimensions of the learning experience. These concepts emphasize the importance of maintaining student motivation, confidence, and well-being in increasingly complex and technology-mediated educational environments. The presence of knowledge and education as foundational terms within the cluster reinforces the broader inquiry into how learning processes are constructed, delivered, and measured under rapidly changing conditions.

Overall, this cluster reveals a research landscape deeply informed by both long-standing educational concerns and urgent contemporary challenges. It underscores a multidimensional approach to understanding education one that considers not only academic outcomes but also student health, engagement, and adaptability in a post-pandemic world increasingly shaped by digital learning.

Cluster 2, which centers around the theme of higher education, brings together a complex network of interrelated terms that reflect current research concerns regarding the student experience, institutional practices, and the evolving context of tertiary education. Among the key concepts associated with this cluster

are student success, retention, transition, COVID-19, stress, instruction, school, impact, skills, quality, participation, student voice, classroom, student education, and competence. Together, these terms outline a comprehensive picture of the dynamics shaping higher education in recent years.

Figure 6. Connections Within Cluster 2: Higher Education
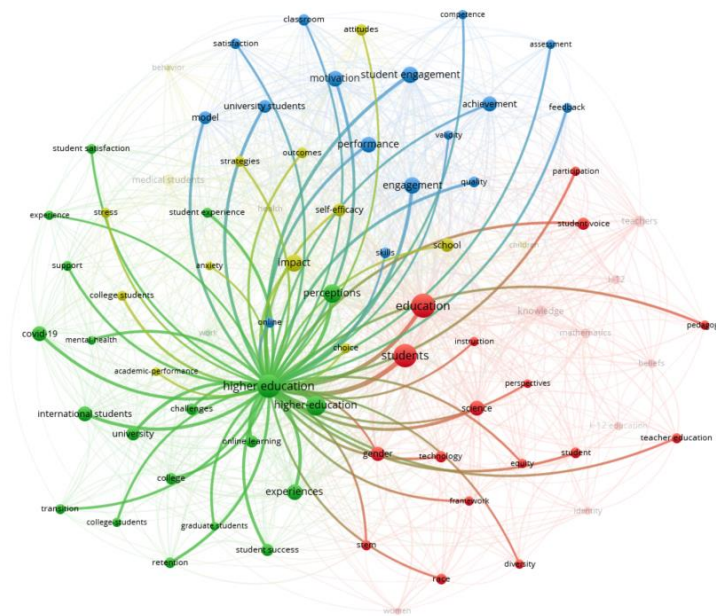
Source: (own processing based on Web of Science Data)

The prominence of terms such as student success, retention, and transition signals a research focus on the academic progression and persistence of students within higher education institutions. Scholars within this thematic area are particularly concerned with understanding the factors that facilitate or hinder students' ability to adapt to university life, complete their studies, and achieve favorable learning outcomes.

The presence of COVID-19 and stress within the cluster highlights the significant impact of the pandemic on the higher education sector. These terms reflect investigations into how abrupt transitions to online learning, social isolation, and increased academic pressure have influenced student well-being and performance. In parallel, concepts such as instruction, classroom, and school point to changing pedagogical practices and institutional responses aimed at maintaining instructional quality under shifting conditions.

Furthermore, the cluster incorporates themes related to skills, competence, and quality, suggesting an ongoing discourse around the relevance and effectiveness of higher education in preparing students for professional and civic

life. The terms participation and student voice emphasize a growing interest in student agency and the inclusion of learner perspectives in shaping educational environments and decision-making processes.

Altogether, this cluster captures a multidimensional exploration of higher education, combining student-centered outcomes, institutional strategies, and broader systemic challenges. It reflects a research agenda concerned not only with academic performance, but also with student engagement, psychological resilience, and the transformative potential of inclusive and responsive teaching practices in contemporary higher education settings.

Cluster 3, structured around the thematic core of school, reveals a dense and meaningful constellation of keywords that reflects current scholarly attention to the psychological, perceptual, and experiential dimensions of pre-university education. The primary terms associated with this cluster include health, perception, stress, mental health, beliefs, knowledge, K-12, teachers, student engagement, outcomes, experiences, identity, and beliefs (notably repeated, suggesting emphasis across multiple contexts). Together, these interconnected concepts outline a research trajectory focused on both the individual and institutional factors shaping the school environment.

Figure 7. Connections Within Cluster 3: School
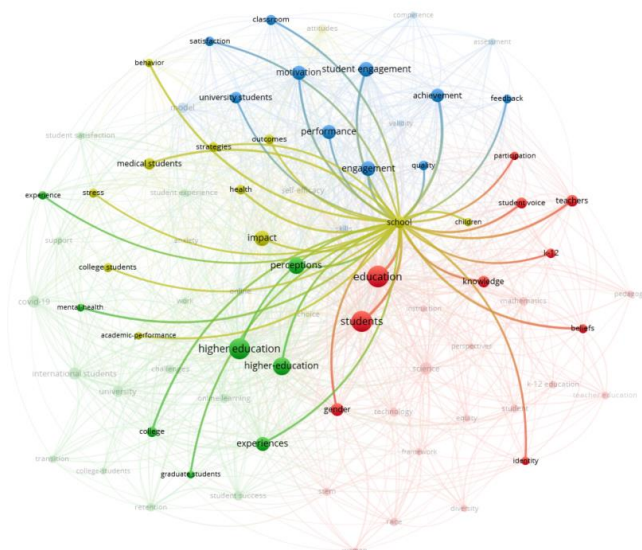
Source: (own processing based on Web of Science Data)

The repeated presence of terms such as mental health, stress, and health underscores a growing body of literature concerned with the well-being of both

students and educators. These keywords suggest that contemporary school-based research increasingly addresses the emotional and psychological pressures faced within K-12 settings, particularly in the wake of rising mental health challenges among youth.

Perception, beliefs, and identity reflect the subjective and socio-cultural dimensions of education, where scholars investigate how students and teachers interpret their roles, form attitudes toward learning, and construct their identities within the school context. These studies often highlight how individual experiences are shaped by broader educational values, norms, and expectations.

Terms such as knowledge, teachers, and student engagement point to core instructional processes within schools, emphasizing the importance of teacher effectiveness, curriculum content, and the active involvement of students in learning. Meanwhile, outcomes and experiences denote an outcome-based orientation in research, where student development is analyzed both quantitatively and qualitatively, through academic performance, emotional growth, and behavioral indicators.

Finally, the inclusion of K-12 signifies the specific educational level addressed in this cluster, situating the research within primary and secondary education systems. The integrated appearance of psychological, cognitive, and instructional keywords reflects a holistic understanding of school as not merely a place of knowledge transmission, but as a complex social and emotional environment that significantly shapes students' long-term educational trajectories.

The final cluster analyzed is centered around the concept of engagement, encompassing a range of interconnected terms that collectively reflect current research efforts to understand how student involvement shapes educational experiences and outcomes, particularly in response to contemporary challenges. This cluster includes key terms such as classroom, attitude, students, education, knowledge, COVID-19, mental health, anxiety, impact, strategies, beliefs, higher education, and pedagogy. Together, these terms suggest a multidimensional approach to engagement that spans cognitive, emotional, and contextual domains.

Figure 8. Connections Within Cluster 4: Engagement
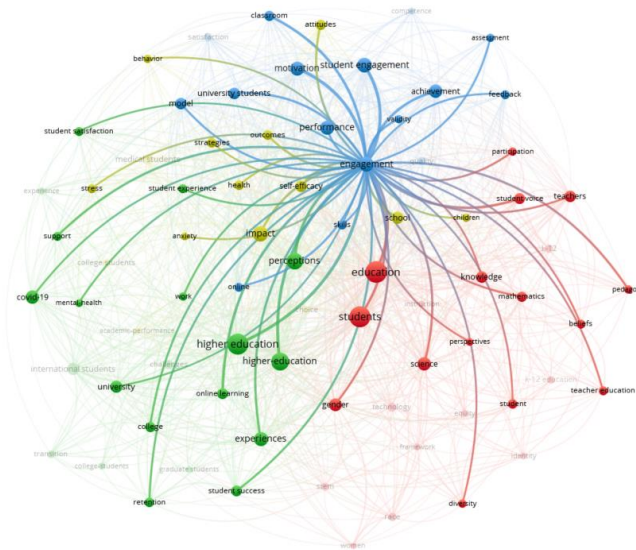
Source: (own processing based on Web of Science Data)

At the core of this cluster, engagement is closely linked to both students and the classroom environment, indicating a strong focus on the interactive relationship between learners and instructional spaces. Research within this thematic area frequently explores how classroom practices, learning atmospheres, and peer interactions contribute to students' motivation, participation, and academic performance.

The presence of attitude, beliefs, and strategies signals an interest in the psychological factors that underlie student engagement, particularly how learners' perceptions and expectations influence their level of involvement. In parallel, these terms also point to pedagogical approaches designed to foster deeper, more meaningful student participation in both in-person and online settings.

Importantly, the inclusion of COVID-19, mental health, and anxiety highlights how the global pandemic has intensified attention toward the emotional and psychological barriers to student engagement. This part of the cluster reflects a growing body of literature that recognizes the need for educational systems to support student well-being alongside academic progress, especially in times of crisis and uncertainty.

The appearance of higher education and pedagogy situates this cluster within a broader institutional and methodological framework, emphasizing how teaching practices at the tertiary level are adapting to meet the changing needs of diverse student populations. It also points to ongoing efforts to design inclusive,

student-centered pedagogies that account for mental health, equity, and digital transformation.

In summary, this cluster represents a rich, interdisciplinary body of research that seeks to understand and enhance engagement through the lens of educational psychology, instructional design, and institutional response. It reflects the recognition that student engagement is not merely an individual trait, but a dynamic outcome shaped by learning environments, teaching strategies, and wider societal influences.

5.   CONCLUSIONS

The use of social media technologies in education has become increasingly relevant in recent years. In the current context, where distance learning has become a necessity, social media networks and other online communication platforms have become important tools for students, teachers, and parents alike. These technologies enable real-time interaction and collaboration, providing a more dynamic and flexible learning experience. Furthermore, they allow access to information and educational resources from any corner of the world, contributing to greater diversity and accessibility of education. However, the use of these technologies in education also presents some challenges, such as the risks associated with data privacy or technology dependency. It is therefore important to develop a balanced and responsible approach to the use of these tools in education.

This paper explored the benefits of using social media in the global education system. After thorough bibliometric research, we conducted a qualitative analysis of the literature data.

This highlighted a number of advantages, such as increasing the students' learning capacity, the variety of open source information sources available to students, facilitating communication between students and teachers, but also a number of disadvantages such as cyberbullying (as highlighted by Chen Yeong Sheng), the teachers' reluctance to use the new technologies, the absence of a social media network geared towards education or the absence of a framework that can suggest a social network specific to each learning scenario (as researched by Yasemin Gülbahar), and so on.

The bibliometric analysis revealed that it is not only students who have problems in adapting to the new realities of the education system, but also teachers who need training to be able to handle the challenges of these realities.

In the context of the COVID-19 pandemic, many schools and universities around the world have struggled to provide traditional, face-to-face education. This has led to the adoption of online learning and, by extension, the increased use of social media in the educational process. Although not originally designed for this use, social media networks have become an alternative solution to

traditional classroom formats and have allowed teachers to stay connected with students in a more accessible and interactive way.

One of the common keywords in the bibliometric analysis is *COVID-19* or *Sars-Cov2*. The pandemic has had a significant impact on the adoption of social media networks by students and teachers alike. Due to the lack of a dedicated tool for distance learning, there was a need to improvise. Thus, teachers stayed connected with students via Facebook, WhatsApp or Facebook Messenger groups, and other social media networks which, although not designed for this use, were useful and successfully adapted to any teaching scenario presented.

Although they present a number of drawbacks, social media networks can be used to complement the current way of teaching. Used correctly, they can enhance the learning process, allowing students to focus and learn the information they really need and are passionate about.

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