Technology aiding Neurodiverse Employees: A Bibliometric Analysis

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Abstract

Neurodiversity encompasses all neurocognitive variations within the human species. It represents the differences in brain function, evident in individuals with conditions such as Autism Spectrum Disorder (ASD), Attention deficit hyperactivity disorder (ADHD), Dyslexia, and Dyspraxia. These variations are not uncommon but are a natural part of human evolution. Technology, in various forms, can redefine work by making processes more efficient and providing real-time support for those who need it, potentially revolutionizing how work is accomplished. Studying neurodiversity and the role of technology in supporting it is crucial, as it can foster a more creative and socially aware society. With the right adaptations and the application of new technologies like AI, we can envision a future where neurodiversity is not only accepted but actively embraced.

To explore how technology supports neurodiverse individuals and to assess research in this area, we conducted a bibliometric analysis. An initial screening yielded 72 publications, which, after careful review, was narrowed to 40 documents for further analysis. In the next stage, a structured literature review was performed, examining the objectives, topics, and research methods on neurodiversity and technology in workplaces across the selected studies. Finally, findings were synthesized in light of the research objectives and existing knowledge. The analysis revealed that inclusive, customizable technology significantly enhances support for neurodivergent individuals in learning, work, and social contexts.

Keywords: Neurodiversity, DEI, Technology, Bibliometrics.

1 Introduction

Neurodiversity refers to all neurocognitive features inside the human species. It represents the variations determined inside the brain, which is obvious in humans affected by conditions that include ASD, ADHD, dyslexia, and dyspraxia; it is not uncommon but a part of human evolution know-how. Neurodiversity helps the know-how that those variations are treasured and important to the human variety. It offers us a brand-new light through which we investigate understanding the human mind; we are encouraged to take our differences in intelligence as some kind of strength in place of being a disadvantage, conventional attitudes in the direction of mental contamination, advocacy on moving from a clinical version of pathologizing variations inside the neurological installation toward a social model and inculcating inclusion, popularity and empowerment of people (Devi & Jagger, 2025). The neurodiversity movement makes a specialty of the strengths and capacity of neurodivergent people in place of the problems that waft from one's situations and argues society wishes to turn out to be extra emotionally intelligent. Neurodiversity contains a host of conditions; each of these has its traits. The most recognizable conditions inside this definition are ASD, ADHD, dyslexia, and dyspraxia.(Hendrickx, 2010). These may additionally affect various aspects of mental functioning, along with social interplay, listening and studying, as well as physical coordination. One type of example is where a few human beings stricken by autism can have special expertise for the processing of words and the conversational capacity of others. Even though these might be weaknesses, especially in an environment that doesn't desire them, in addition, they provide strengths together with the recognition of the skills of the version and the real expression of his or her pursuits. Humans with ADHD seem very creative, and lively, and have properly hassle-fixing competencies however have issues with awareness and persistence(Gayen, n.d.). Similarly, human beings laid low with dyslexia gift problems with analyzing and phrase processing however are typically good at responsibilities requiring ideas and reasoning. In lots of approaches, it impacts motor talents and coordination, so things like writing or working with equipment turn out to be tough. But human beings who've issues aren't surely challenged with the aid of their brains' potential to suppose solutions in a way that is non-bodily.(Cobbaert & Rose, 2023). This means that the

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distinction between the mind and the brain is not a weakness but as a substitute a skill that requires strengths. Paradigm, amongst many conditions, is likewise observed within the spectrum of neurodiversity, together with conditions including dysgraphia, which impacts writing and best motor capabilities, and misophonia, which is referred to as sensitivity to specific sounds(Cobbaert & Rose, 2023). Individuals with slower processing speeds make it take longer to read and method a conversation message and to respond correctly. This does not, but decrease their capability to make powerful contributions in lots of contexts.

Another circumstance is Tourette syndrome, associated with non-developmental and often emotional expressions of abuse through speech or otherwise. While such situations are normally stigmatized, they may be part of human neurodiversity and ought to be supported in preference to stigmatized. The encouragement of neurodiversity can facilitate an ambient environment where humans with numerous talents flourish in regular interaction, turning complex visions into innovation and creativity opportunities (Hutson & Hutson, 2023b). Agencies are under strain in a brand new aggressive global marketplace to make a diverse team of workers and encourage new ideas and fresh wondering. The inclusion of neurodivergent staff may be an important source of this give-up. Neurodivergent brings new methods of wondering and problem fixing into a place of work; they may method demanding situations in ways that neurotypical human beings generally tend no longer to range of thought ends in innovative solutions and can be an organizational competitive gain that is valuable and proper in commercial enterprise. Also, the creativity and hassle-solving skills of a character diagnosed with ADHD may fuel innovation and increase projects (D'Eri, 2023). In this light, corporations can leverage the talent pool, which otherwise will be left out in development, for their DEI efforts, given the establishment of neurodivergent workers within roles that suit their nature. Consequently, neurodivergent individuals face better rates of unemployment and loss of jobs than the overall population. it's far partly due to a misunderstanding of their talents and no longer tailoring the work surroundings to their precise desires, two of the main challenges in locating and maintaining career possibilities. From the beginning of the hiring system to the workday, many companies fail to fulfil their wishes (Schwartz et al., 2010). As an example, recruitment is built up on social behavior tendencies, together with looking each other in the eye, handshakes, and small talk-functions that many people enjoy and are from time to time awkward or beside the point to behavior at work. As a result, healthy applicants are left out due to the fact they do now not fulfill the social necessities of conduct. maximum corporations continue to be unable to discover the preference for range "culture" that results in low workforce retention. The environment also is not very supportive as the specific needs of neurodivergent workers are misunderstood and often ignored. Legal rules and guidelines for neurodivergent workers are restrictive, and lack of assistance leading to increased stress, burnout, and turnover (Newson A 2024). Protecting-the neurodivergent features are blanketed up or suppressed as a good way to fit in with their neurotypical colleagues where the practice does prevent embarrassment, it's at a high price. Protecting is frequently related to the buildup of pressure and even burnout, mental fitness issues like melancholy and tension, and enough pressure to push neurodivergent people out of the group of workers entirely.

As the era improves, AI is currently becoming an increasingly effective tool to help neurodivergent human beings inside the place of work (Keil & Ketzer, 2024). This technology, in different phrases, can redefine work by way of making it extra green and offering actual-time assistance to conditions requiring it, therefore potentially revolutionizing the way work is achieved. To neurodivergent workers, this technology, particularly, will assist them with obligations that call for running memory, interest in elements, and focus on better-stage tasks. For instance, a person with autism may additionally have difficulties in undertaking to switch because of hyperfocus whilst a man or woman with ADHD can't be cognizant even of repetitive obligations. Consequently, AI can reduce the revel in of such sports by automating it and boost productiveness and activity satisfaction through the development of human skills in personnel to attention more to their strengths (Mindell & Reynolds, 2023). One truly cannot inform humans aside. actual-time AI era allows for the seizure and next garage of vital data, assuring that info isn't lost in the course of the system. That is helpful to personnel who have trouble remembering things over a short duration or who battle to multitask.Such inclusion benefits both the employee and the business enterprise, making productivity and innovation go higher. It makes us question our mindset with cognitive variations and promotes the ability that neurodivergent individuals offer to society.

2 Literature Review

Neurodiversity has been the core concept of much of the research and discussion in the fields, particularly about ASD and other related conditions. It is in this context that the term "neurodiversity" itself challenges traditional views regarding neurological difference, highlighting variations in brain function as an integral, and indeed valuable part of human diversity. Researchers, such as Tincani et al., furthered the importance of neurodiversity, specifically for those with ASD, and attempted to implement evidence-based practices in supporting and empowering them. This therefore contributes to the development of respect and appreciation for diversity within both the neurodivergent population and society at large. The current article works on the basis that has been laid out by Tincani et al., while considering the deep impact that these emerging technologies have on the quality of life among neurodivergent people. At the same time, as the authors note, with such technologies, potential risks come in terms of ethics and legality, like the breach of privacy and data misuse, as well as considerations about the ethics of the artificial modification of natural neurological functions. Such aspects are reflected in the paper they produced, revealing clearly how technological changes manifest themselves in double-edged swords that promote equilibrium toward the enhancement of the well-being and autonomy of neurodivergent persons (Tincani et al., 2009). Neurodiversity and technology: an ongoing theme in academia and practice. The field of neurodiversity has experienced an explosion of research and technological developments in efforts to enhance the quality of life for individuals with diverse cognitive profiles. MacKenzie R. and Watts J. critically examined existing and emerging technologies that allow people with impairments to overcome challenges. Their work showed opportunities to enhance lives while cautioning about ethical and legal issues, especially concerning neurodiversity. This initial exploration led to a succession of subsequent research and innovations (Mackenzie & Watts, 2011). O'Connell's neuroimaging technology has indeed marked our view of the human brain. Thereby, by way of this consideration alone, the old views have always been about treatment like it was just a self-containment and isolated organ. But what O'Connell's work shows is far from that. The topic addresses the brain as a living organism that changes with time, not only a structure of biological factors, nor social influences that might modify this, or environmental factors with this, a combination of all these. These perspectives have deep significance to self-identity, concerning how neurodivergent individuals travel within their environments(O'Connell, 2011). There is, then, the cultural level forming our view of neurodiversity. Kapp's study offers an effective contrast between the Western medical model looking at autism-constantly framed as a "disease" requiring a treatment and the Navajo concept of Hozho, which places great importance on harmony, balance, and interconnections and hence presents a far more holistic view of autism. This cultural lens suggests that focusing on autism from the angle of the medicalized only limits the appreciation for the full neurodivergent experience. By embracing diverse cultural constructs, researchers and practitioners could work up more inclusive, empathetic approaches for neurodivergent support. There is finally the cultural level, shaping the perception of neurodiversity. Kapp's work will serve to contrast the medical Western understanding of autism: an autistic child as if with some disease to be treated with treatment, to the Navajo concept of Hozho, with all the emphasis on balance and connection. That, perhaps, is why one senses that the tendency to envision autism in strictly medicalised terms may be somehow impeding the ability to find a proper appreciation of all the scope of neurodiverse experiences. The interaction and integration of different cultural constructs allow researchers and practitioners work through more inclusive and empathic responses(Kapp, 2013). Hart B in his study examines the perspective of autism as pathology is one that parents of autistic children and relatives of such children, who use autism therapies and engage in supportive practices, have aided in promoting. It resonates well with the neurodiversity movement in that it seeks to enhance the social acceptance of individuals with autism(Hart, 2014).

Technology cannot be under-emphasized in terms of its role in enhancing the lives of neurodivergent individuals. Brosnan et al. demonstrated that the value could be demonstrated by including technological solutions, specific needs, and preferences across all age ranges both verbal and non-verbal if neurodiverse communities were engaged with the design and development of technologies. These initiatives lay down the groundwork for innovation that will help neurodivergent persons and society at large as well(Brosnan et al., 2017). Technological advancement continues to change the neurodivergent landscape in profound ways. Yavari et al. suggested a spatial-mechanistic optimization of transcranial electrical stimulation (tes) for neurological disorders. The paper deals with the issue of individual variability in the treatment response, offering a more personalized approach to neurological interventions(Yavari et al., 2017). Similarly, Demo's analysis of autism-focused apps highlights the need to expand the concept of agency, which is a function of the interplay between human users and technological tools. This view challenges the traditional understanding of agency, promoting an integrated understanding of human-technology interactions(Demo, 2017) stressed how the problem is in trying to understand how to take into

account the specific features that characterize how autistic children work with technology. There has been so much effort going into research and understanding conducted by non-autistic persons that it can easily cause bias in the understanding and interpretation. This requires high inclusion of autistic individuals during research and design to address representation. This means that this approach enhances the relevance and effectiveness of technological solutions and provides a better understanding of neurodivergent experiences(Spiel et al., 2017). Societal attitudes toward autism have dramatically changed with time. Cooper's work contests the classical disorder-based model of autism and, based on strength, opines that the need is to focus more on autistic strengths and unique contributions made to society (Cooper, 2018). Here is a shift from deficit to strengths, valuing input by neurodivergent people into society. Even as inclusion is of utmost need by them in the work of Alper, "The sensory experiences of autistic children" are vital, as an inclusive ethnography of sensory experience also would demand a certain respect and accommodation toward various needs for which the sensory experience should provide for the autistic individual (Alper, 2018).

The principles of neurodiversity are increasingly being accepted within important sectors like education and employment. According to Carrero et al., organizations, such as DXC Technology, have efforts to create Neurodiversity Hubs. These hubs are expected to provide neurodivergent individuals with equal employment opportunities, mitigating systemic barriers that excluded them from the workforce historically (Carrero et al., 2019). Likewise, Politis et al. made it clear that participation was crucial in the design of the technology so that it serves the particular needs and tastes of autistic users. This kind of endeavor promotes an integrated and cooperative society by achieving inclusiveness(Politis et al., 2019). Among the issues that concern people these days is the usage and effects of technology in school settings. Lei et al., looked into the strengths of, and barriers to, preferences faced by autism e-learners about distinctive aspects and challenges faced in autistic learning. These researchers conclude the opportunity that could facilitate better experiences for learning neurodivergent student access via technology-based learning facilitation(Lei et al., 2021). Such an approach to the role of technology in developing social interactions in neurodiverse couples further emphasizes the versatility and suitability of technological solutions when implemented for diverse needs, which is further stressed in the work of Mitran. Accessibility is still very much a significant concern in the development and implementation of technological solutions(Mitran, 2022). Lukava et al., discussed the barriers in Extended Reality technologies and suggested customization or adaptability in Extended Reality technologies for neurodivergent users. This study indicates that what may be needed is an acknowledgment of differences in people or preferences and designing the system in a way that is inclusive and amenable to use (Lukava et al., 2022). Ward et al., discussed participatory design projects which concerned collaborations between researchers, industry professionals, and autistic adolescents. Such projects prove the significance of inclusive design processes with added value for collaborative working and mutual understanding between neurodivergent people and the general society(Ward et al., 2022).

The workplace has become neurodiverse by focusing more on creating supportive environments for neurodivergent employees. Tomczak studied how digital tools can support communication and stress management with autistic employees. The tools help find practical solutions to everyday problems neurodivergent people face in a work setting, thus keeping them healthy and productive. Schuurmans documented efforts in the Netherlands to develop sustainable IT employment opportunities for autistic people, with a focus on contextual support. This kind of initiative reflects the value of shifting focus from intrinsic deficits to contextual strengths, which can lead to a more inclusive and equitable workplace culture(Tomczak, 2022). Technology is continually inventing and broadening horizons in neurodiversity research and practice. Hong et al., provided a model for the MRI classification of Alzheimer's disease stages, thereby demonstrating potential in advanced algorithms for neurological differences understanding and addressing. Although the study is about Alzheimer's, its wider implications for neurodiversity research demonstrate the use of technology in finding new insights and solutions (Hong et al., 2022). Farroni T. et al. underscored the prospect of using multimedia technologies and virtual reality for children's multidimensional development (Farroni et al., 2022). Jia et al., examined the relationship between autism traits and interest in IT and showed that the current understanding of engagement with IT needs to shift across cultural contexts, and the findings are considered within cultural and individual differences in design and technological implementation(Jia et al., 2022). Further, Kálózi-Szabó et al., used educational robotics to analyze whether there was cognitive and social enhancement between neurodiverse and neurotypical students. Their findings demonstrated substantial improvements in reading accuracy, comprehension, and overall abilities after the participation of the students in robotics programs. This study, therefore, brought into the limelight how technology can be an enabler of inclusive learning (Kálózi-Szabó et al., 2022). Still, despite such advancements, problems are also still present. Dali K. and Charbonneau D.H. identifies major challenges neurodiverse Ph.D. students face in Library and Information Science programs, such as limited support services and inaccessible

environments (Dali K. and Charbonneau D.H. 2023). Syharat C.M. et al., found that neurodivergent graduate students often have to suppress their non-neurotypical practices in STEM fields. A lot of these students reported that they had to self-silence in order to maintain their professional relationships, but they still acknowledged that their neurodivergence was a source of unique strength(Syharat et al., 2023). Hand C.J. studied the experiences of neurodivergent undergraduates with a focus on importance of preparation and audience perception, both in education and the workplace presentations. These conclusions underscore the role that support-building and tailored support can be used in developing both personal as well as professional development of neurodivergent individuals (Hand, 2023). Welch C. et al., did discourse analysis on online forums within some alt-right communities to comment on how society views autism. The term "weaponized autism" was used both to praise and mock, further proving the necessity of increasing education and awareness of autism within society (Welch et al., 2023)

Kwon J. et al., have described the way virtual reality and wearable technologies could improve interaction of a human with his surroundings by the application of Participatory Neurodesign (PND). This methodology is based on the heterogeneity of the user cognitive styles. This method was used to create inclusive environments in which a variety of needs are accommodated for both senses and cognition(Kwon et al., 2023). Communication technology has also played a transformative role. Zolyomi A. and Snyder J. explored how visual aids and assistive ICT could empower conversations between neurodiverse individuals, particularly autistic and non-autistic people. These tools have been well in bridging gaps regarding differences in communication styles and orientations (Zolyomi & Snyder, 2023)Employment avenues for neurodivergent also included. Schuurmans, J.A. et al recorded a participatory company based in the Netherlands supporting employment in sustainable IT jobs to individuals on the autism spectrum. Their approach was the basis of contextual support than of intrinsic deficits. This presents the model for other organizations(Schuurmans et al., 2023)). COVID-19 has greatly affected the face of education. According to Horlin C. et al., it has been discovered that neurodivergent and disabled students enjoyed the recorded classes. It's really cool how features like pause and speed adjustment let a student learn at his/her pace, and thus this is how flexible teaching can actually help learners (Horlin et al., 2024)Further research into participatory design in architecture was conducted by Rispoli M. and Criado T. Their research centered on the necessity of designing spaces that are capable of hosting different sensory and cognitive experiences, including non-verbal interactions. These principles have begun to transform public and private spaces to be more inclusive (Rispoli & Criado, 2024).

Technological innovations have also affected early childhood education. Aslan S. et al. designed "Kid Space," a multimodal conversational AI system designed to ease the fears of parents over screen time and socialization. Significant educational content reported by parents to apply this software with their children(Aslan et al., 2024). Neurodiversity is increasingly acknowledged all over the world. Almakrob A. et al, conducted a study on neurodiversity practices in Saudi Arabia based on the demand for more inclusive frameworks at the level of learning and working environment. The research has helped similar practices around the (Almakrob et al., 2024) Aziz O. et al., worked on the development of ArchaeoMeta, a virtual museum framework anchored on distributed ledger technology. It explored how cultural heritage could be seen as intersecting with the Metaverse. The framework enhances interaction with cultural resources and solves problems of scalability and security(Aziz et al., 2024). Accessibility in education still is an issue of great importance. Borsotti V. et al., initiated the concept of "access grafting," which implies improvement in organizational structures with a view to increasing equity. Their research provided actionable recommendations toward making educational spaces more inclusive(Borsotti et al., 2024). Wang K.D. et al., within the framework of STEM education, requested more inclusive pedagogies to facilitate the overcoming of challenges that neurodiverse students face. Among them are learning materials of interest to students and support intended to focus attention(Wang et al., 2024). Digital transformation has also emphasized the significance of neurodiversity. Walkowiak E., noted that inclusive actions in technology may counteract bias and accommodate diverse thinking, encouraging innovation while respecting mental health (Walkowiak, 2024)Sharma N.B. and Jha B. emphasized the benefits of digital and transmedia storytelling in creating welcoming environments for individuals with autism spectrum disorders. These strategies are used in community-based initiatives as well to promote integration(Sharma & Jha, 2024). Ritzman M.J and Subramanian R studied computer-mediated communication use among young people with autism. All benefits of these tools notwithstanding there are drawbacks such as social comparison, and lack of intimacy as well. It is a task in progress to strike an equilibrium between technology and people Ritzman (M.J and Subramanian R 2024). The works and innovations reflect better dedication toward understanding and appreciating neurodiversity. They can be seen and marked for such transformative changes, reflecting inclusion in technology, whether that comes from education to employment and finally into design.

3 Methodology

3.1 Bibliometric Analysis

Bibliometric analysis is the study of patterns in publications and citations. It is a tool that can be used for various purposes, such as measuring the impact of a journal article or assessing the research productivity of an academic department. The origins of bibliometric analysis can be traced back to the early days of citation indexing. In the late 19th century, French sociologist Pierre Bourdieu began using citation analysis to study the relationships between different fields of knowledge. **(Rahul Pratap Singh Kaurav, 2022)**

3.2 Neurodiversity

Neurodiversity refers to all neurocognitive features inside the human species. It represents the variations determined inside the brain, which is obvious in humans affected by conditions that include autism spectrum ailment ASD, ADHD, dyslexia, and dyspraxia; it is not uncommon but a part of human evolution.

3.3 Technology in Neurodiversity

Technology, in different phrases, can redefine work by way of making it extra green and offering actual-time assist to conditions requiring it, therefore potentially revolutionizing the way work is achieved.

3.4 The importance to study neurodiversity and technology

Researching neurodiversity and the technology used in neurodiversity is significant because it can contribute to a more creative and socially aware society. With the right adaptations and the use of new technologies like AI, we can collectively create a future where neurodiversity is not only accepted; but rightly implemented.

In the first stage of data collection, 142 publications were identified, including the keywords: “workplace”, “neurodiversity” and “technology”.

In the second stage of data collection, the search criteria were limited to the selected areas such as: “social sciences”, “neuroscience”, “psychology”, and “business, management, accounting”. As a result, 72 publications were identified for further analysis.

In the third stage, the search criteria were limited to the language “English” as a result 69 publications were identified for further analysis.

In the next step, for the type of document, the search criteria were limited to “articles”, as a result, 69 publications turned to 40 documents for further analysis.

In the next stage structured literature review was conducted, covering an analysis of the objectives, topics, and research methods on neurodiversity and technology in workplaces in the selected subject areas by detailed screening and reading of 40 papers.

In the last stage, the synthesized findings from the previous stages were interpreted in the context of the research objectives and existing knowledge in the field and found inclusive, customizable tech boosts support for neurodivergent people in learning, work, and social settings.

4 Results

Fig. 1. shows the development of research on the topic of "Neurodiversity in Technology" published in Google Scholar-indexed journals 40. The data presented in the figure shows the annual production of articles produced over time from 2009 to 2023

Early years 2009 to 2024, the number of articles produced was very low, with some years like 2012 and 2015 not having articles at all. Peaks in the article publication are observed in the years like 2011,2017 and especially from 2021 onwards. A sharp rise appeared from 2022-2023 indicating a potential phase of increased emphasis on the research.

4.1 Annual Scientific Production

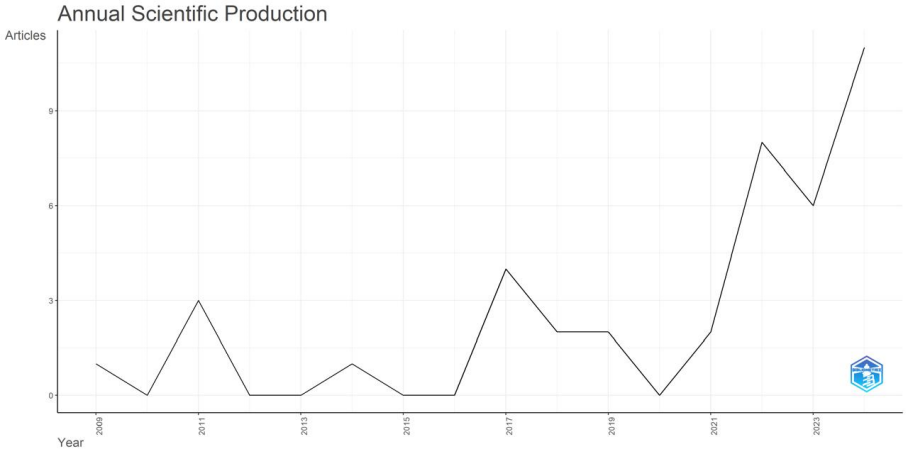

Figure 1: Annual Scientific Production

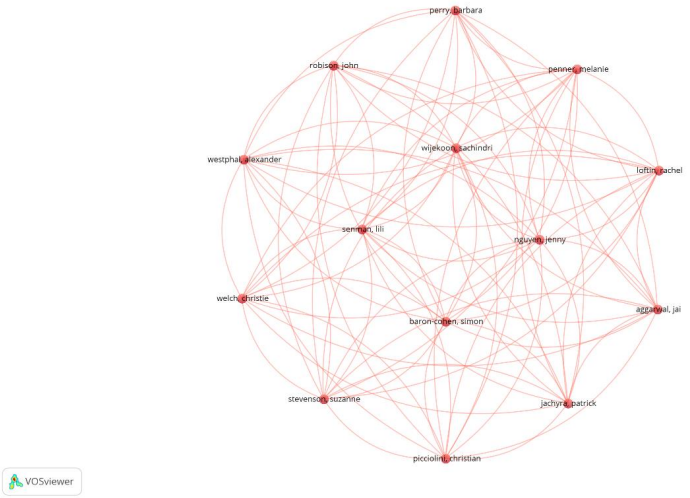

Figure 2: Co-authorship

Fig. 2., presents the co-authorship or the common research themes in which connections of authors or topics are portrayed. It has 13 nodes- authors or topics-and a multitude of links, denoting their relation as indicated by the figure. It has a network that is quite interconnected and hence reflects high collaboration or a great deal of overlap in research. Some names that are highlighted are "Wijekoon Sachindri," "Nguyen Jenny," and "Loftin Rachel," which are associated with a lot of others, which proves they are key in this area. The robust associations indicate a coherent research topic on neurodiversity, and there could also be smaller clusters within the network that work on neurodiversity.

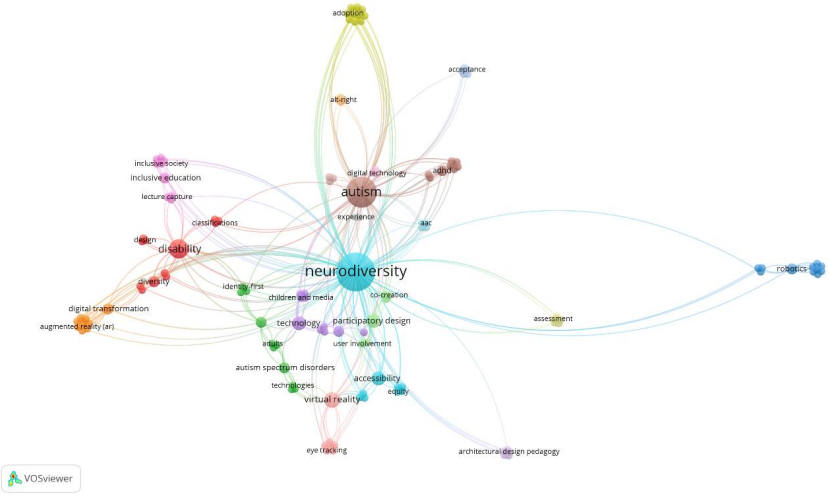

Figure 3: Keywords

Fig. 3., shows “neurodiversity” as the central keyword that has emerged most prominently and centrally in the node, showing how important this topic is to the body of research. Centrality indicates that most related studies and keywords are around neurodiversity and are seen as the prime lens through which related themes such as "autism," "disability," and "technology" are viewed This centrality indicates that most related studies and keywords cluster around neurodiversity. The word "adoption" with the number of links 20, the total link strength is 95. The second word is “Autism” with a total of 40 links and a total link strength is 190 and the third term is “Disability” with a total of 35 links and a total link strength is 155(see figure).

On the other hand, fading-related terms such as digital transformation, and co-creation do not appear at all. These clusters are far away from the central clusters like robotics, and augmented reality. These terms indicate the lack of research interest topics by Google scholars. The connection between the clusters helps to indicate different themes like technology, inclusion and, education and on the other hand, there are less connected keywords such as “adoption”, and “identity first” which require more research or investigation.

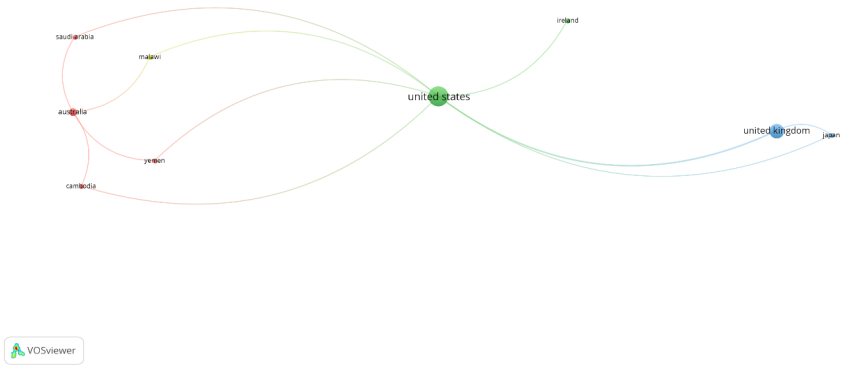

Figure 4: New Countries

Fig. 4., the network exhibits that "The United States" is the biggest and most central node which makes it act like a hub connecting various other countries. It connects with many other nodes like "United Kingdom," "Saudi Arabia," "Australia," and "Ireland" hence making it form a very dense central cluster. The United Kingdom is also a powerful node, but it is connecting to very significant countries like Japan and others in its cluster.

The network consists of 10 node countries and 15 connections, indicating how much these countries collaborate or have shared work. At least six nodes are directly connected to the United States, which means that the latter plays a central role. For the United Kingdom, just a few, yet crucial, connections give an impression of an obvious secondary cluster. Others, like Cambodia, Malawi, and Yemen, are small nodes; it reflects their peripheral status in the network.

It breaks up into three clusters along three main colors.

I. The Green cluster - The United States: includes Ireland, and Malawi. Indicates many interactions.

II. Blue cluster (United Kingdom) - Includes links such as Japan, which indicates regional or thematic partnerships.

III. Red cluster (Saudi Arabia and Australia) - Contains nodes such as Cambodia and Yemen, which exhibit relatively weak but quite specific interactions.

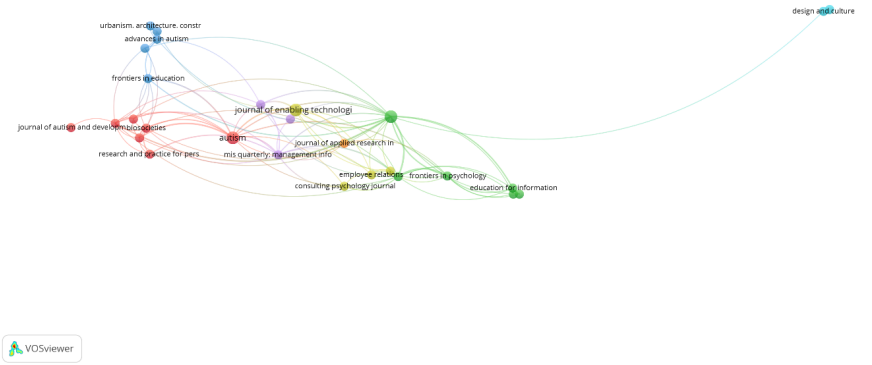

Figure 5: Sources

Fig. 5., it points out the center and connections of key nodes in the research network. It shows that "autism" is the most related node with the highest degree of links that cross across 2 networks, showing the importance of the research field. The green network consists of 6 links in the "journal of enabling technology" interested in both technology and workplace inclusion while being related to psychology, a red network of 5 links that carries the "journal of autism and developmental disorders" while having a high significance due to 4 links in the "research and practice for persons". Similarly, "frontiers in psychology" contains 4 links in the green cluster that link psychological themes to interdisciplinary ones. The "blue network" is tiny and contains "advances in autism" with 3 links as emerging research themes. It is remarkable that "design and culture" contains only 1ink that seems to be integrated in the rest of the research topics.

This again signifies that autism and enabling technologies have the maximum connectivity in the red and green networks, but blue networks and the isolated nodes signify further study and potential collaborations.

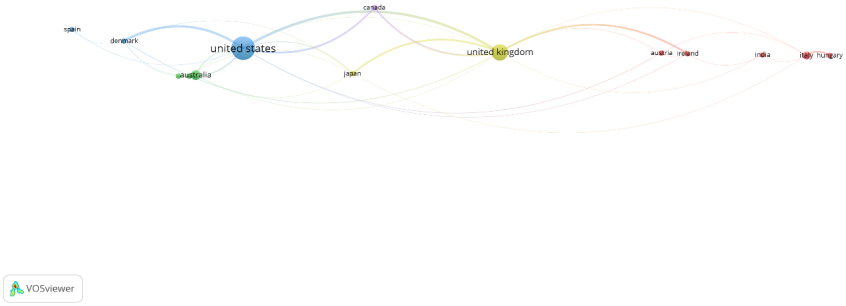

Figure 6: Affiliations

Fig. 6., the network depiction finds "United States" at the top, giving way to its central nature over research landscapes. Again, the United States is of major importance because of its larger size, and it contains far-flung connections as one goes down the ranks -United Kingdom, Canada, Australia, and Japan amongst its several connections. This thus explains collaboration and influence across various international networks of research. This node acts as a hub since the United States has significant link strengths with multiple countries, making the United States a key node in knowledge exchange and academic collaboration.

The "United Kingdom" is another influential node as it is a second major node, with its connections going toward Ireland, Canada, India, and Austria. The node position demonstrates its status as a research bridge for several clusters of research. Countries such as Denmark, Spain, and Hungary have fewer connections, which indicates that these countries are relatively less involved in international collaborations. The overall connectivity pattern of the network suggests the presence of 13 nodes with different connectivity grades. The centrality of two highly connected nodes-the United States and the United Kingdom-helps elucidate their status and that of smaller nodes-Austria and Hungary-for possible extension areas to be explored. Connectivity discrepancy, therefore, represents this iniquity and impropriety in the collaborations of different countries in the world.

4.7 Countries

Figure 7: Countries

Fig. 7., the most prominent and interconnected node in the research network is "Nitsche M.A.," which points out that it is the most important node in the centrality of the network. Therefore, the majority of the co-citation studies are centered around Nitsche M.A., thereby showing its importance as a key contributor to the field connects strongly with other authors like Taylor J.L., Castellanos F.X., and Wang Y. - all of them form a well-defined cluster with a high number of links and total link strength. This would imply that their works are frequently cited together, possibly sharing common research themes or complementing each other.

The author "Baron-Cohen S." forms a separate, smaller cluster with fewer connections. The research interests or the co-citation patterns may be diverged due to isolation of this cluster from a central network dominated by Nitsche M.A. Overall, there are 7 nodes altogether in the visualization and divided into two distinct clusters. The centrality of Nitsche M.A. points out the importance and the dominancy in that particular research area, and the low centrality score of Baron-Cohen S. would indicate some shortage of crossdisciplinary or cooperative citation. This indicates the fact that some authors, for example, Nitsche M.A., play important roles in this research network, while some clusters, like Baron-Cohen S., are more specialized or emerging themes in scientific research and are therefore needed to be taken more into consideration in the science discussion.

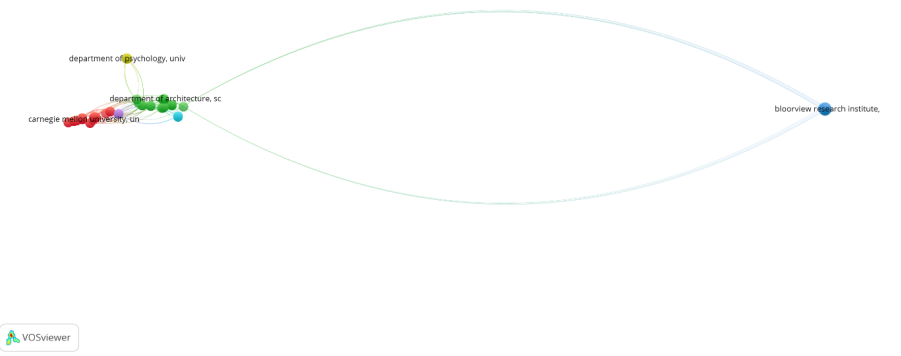

Figure 8: Co-citation

Fig. 8., Bloorview Research Institute is proven by the figure to be of vital importance and dominance in relation to the network. Central it is, dominant, thus holding a high degree level that shows its importance toward building collaborations or producing influential research outputs."Bloorview Research Institute" has formed an isolated cluster, which signifies the strength of its independent research contribution from the rest of the network.

On the other hand, nodes like the "Department of Psychology" and the "Department of Architecture" that are moderately connected constitute the network around Carnegie Mellon University. These nodes form a smaller, more localized cluster of focused collaboration and thematic agreement within the institution. It is comparatively weakly linked to the "Bloorview Research Institute," suggesting much less cross-interdisciplinary collaboration or even knowledge flow between these two dominant nodes.

In this complete network of 6 nodes, two primary clusters contain all the nodes: First comes Bloorview Research Institute, which takes leadership in the research realm both through connectivity and influence, it has a dominant position in such a network. A more localized strength is observable with Carnegie Mellon University-based or those with affiliated departments, not linked, however, to all those other influential nodes within its network. This division indicates the possibility of further research collaborations to fill in the gap between these clusters, which will eventually allow greater integration and interdisciplinary exploration within the network.

4.9 Table Analysis of Data

Table 1 is based on the data from the published Neurodiversity in Technology application from the Google Scholar databases(40). A total of 447 articles were taken and analyzed. The data is in the form of the author's name, title, year of publication, no of citations, article link, and related URLs. The sample data consists of 19 relevant papers, all papers used in this study include total citations of 1004,100.40 average annual citations, 2.46 average author paper and the average H-index of all the papers is 12 and G-index 17

Numbers	Authors	Title	Year	Cited by
1	Tincani M.; Travers J.; Boutot A.	“Race, culture, and autism spectrum disorder: Understanding the role of diversity in successful educational interventions”	2009	62
2	Hart B.	“Autism parents & neurodiversity: Radical translation, joint embodiment and the prosthetic environment”	2014	55
3	Lei J.; Jones L.; Brosnan M.	“Exploring an e-learning community’s response to the language and terminology use in autism from two massive open online courses on autism education and technology use”	2021	43
4	Spiel K.; Frauenberger C.; Fitzpatrick G.	“Experiences of autistic children with technologies”	2017	38
5	Kapp S.K.	“Navajo and autism: The beauty of harmony”	2011	33
6	Lukava T.; Morgado Ramirez D.Z.; Barbareschi G.	“Two sides of the same coin: accessibility practices and neurodivergent users' experience of extended reality”	2022	32
7	Alper M.	“Inclusive sensory ethnography: Studying new media and neurodiversity in everyday life”	2018	28
8	Yavari F.; Nitsche M.A.; Ekhtiari H.	“Transcranial electric stimulation for precision medicine: A spatiomechanistic framework”	2017	25
9	Carrero J.; Krzeminska A.; Härtel C.E.J.	“The DXC technology work experience program: Disability-inclusive recruitment and selection in action”	2019	22
10	Tomczak M.T.	“How can the work environment be redesigned to enhance the well-being of individuals with autism?”	2022	16
11	Jia R.; Steelman Z.R.; Jia H.H.	“What Makes One Intrinsically Interested in IT? An Exploratory Study on Influences of Autistic Tendency and Gender in the U.S. and India”	2022	15
12	Brosnan M.; Holt S.; Yuill N.; Good J.; Parsons S.	“Beyond autism and technology: lessons from neurodiverse populations”	2017	14
13	Walkowiak E.	“Digitalization and inclusiveness of HRM practices: The example of neurodiversity initiatives”	2024	12
14	Syharat C.M.; Hain A.; Zaghi A.E.; Gabriel R.; Berdanier C.G.P.	“Experiences of neurodivergent students in graduate STEM programs”	2023	11
15	Demo A.T.	“Hacking agency: Apps, autism, and neurodiversity	2017	10
16	Farroni T.; Valori I.; Carnevali L.	Multimedia Interventions for Neurodiversity: Leveraging Insights from Developmental Cognitive” “Neuroscience to Build an Innovative Practice”	2022	7

17	Politis Y.; Olivia L.; Olivia T.	“Empowering autistic adults through their involvement in the development of a virtual world”	2019	7
18	Kálózi-Szabó C.; Mohai K.; Cottini M.	“Employing Robotics in Education to Enhance Cognitive Development—A Pilot Study”	2022	6
19	MacKenzie R.; Watts J.	“Robots, social networking sites and multi-user games: Using new and existing assistive technologies to promote human flourishing”	2011	6
20	Hand C.J.	“Neurodiverse undergraduate psychology students' experiences of presentations in education and employment”	2023	5
21	Horlin C.; Hronska B.; Nordmann E.	“I can be a “normal” student: the role of lecture capture in supporting disabled and neurodivergent students’ participation in higher education”	2024	3
22	Dali K.; Charbonneau D.H.	“Academic ableism and the experiences of disabled and neurodiverse Ph.D. students in LIS programs”	2024	3
23	Ward V.; Parsons S.; Kovshoff H.; Crump B.	“Co-creation of Research and Design During a Coding Club With Autistic Students Using Multimodal Participatory Methods and Analysis”	2022	3
24	O’Connell K.	“From black box to ‘open’ brain: Law, neuroimaging and disability discrimination”	2011	3
25	Mitran C.L.	“A New Framework for Examining Impact of Neurodiversity in Couples in Intimate Relationships”	2022	2
26	Luchs C.	“Considering Neurodiversity in Learning Design and Technology”	2021	2
27	Aslan S.; Durham L.M.; Alyuz N.; Chierichetti R.; Denman P.A.; Okur E.; Aguirre D.I.G.; Esquivel J.C.Z.; Cordourier Maruri H.A.; Sharma S.; Raffa G.; Mayer R.E.; Nachman L.	“What is the impact of a multi-modal pedagogical conversational AI system on parents' concerns about technology use by young children?”	2024	2
28	Welch C.; Senman L.; Loftin R.; Picciolini C.; Robison J.; Westphal A.; Perry B.; Nguyen J.; Jachyra P.; Stevenson S.; Aggarwal J.; Wijekoon S.; Baron-Cohen S.; Penner M.	“Understanding the Use of the Term “Weaponized Autism” in An Alt-Right Social Media Platform”	2023	2
29	Zolyomi A.; Snyder J.	“Designing for Common Ground: Visually Representing Conversation Dynamics of Neurodiverse Dyads”	2023	2
30	Borsotti V.; Begel A.; Bjørn P.	“Neurodiversity and the Accessible University: Exploring Organizational Barriers, Access Labor and Opportunities for Change”	2024	1

31	Ritzman M.J.; Subramanian R.	“Voices from a pandemic: Understanding how young adults on the autism spectrum use computer-mediated communication”	2024	1
32	Schuurmans J.A.; de Wit E.E.; Bunders-Aelen J.G.F.	“THINKING DIFFERENTLY WORKS: UNDERSTANDING THE ESSENTIAL ELEMENTS FOR THE SUCCESS OF A COMPETITIVE INTEGRATED EMPLOYMENT PROGRAM DEVELOPED FOR PERSONS WITH AUTISM SPECTRUM CONDITIONS”	2023	1
33	Wang K.D.; McCool J.; Wieman C.	“Exploring the learning experiences of neurodivergent college students in STEM courses”	2024	1
34	Hong X.; Huang K.; Lin J.; Ye X.; Wu G.; Chen L.; Chen E.; Zhao S.	“Combined Multi-Atlas and Multi-Layer Perception for Alzheimer's Disease Classification”	2022	1
35	Kwon J.; Linihan S.; Iedema A.; Schmidt A.; Luo C.; Marrufo K.	“How interior design responds to neurodiversity: implementing wearable technologies in neurodesign processes”	2023	1
36	Rispoli M.; Criado T.	“Design Before Design: Learning to be Affected by Neurodiverse Spatial Practices”	2024	0
37	Cooper T.	“Orbiting the neurotypical universe: Aspergian narratives by Lydia Netzer and John Elder Robison”	2018	0
38	Almakrob A.; Alduais A.; Be B.; Mhone A.	“Neurodiversity in Saudi Arabia: A Conceptual Model for Inclusive Practices”	2024	0
39	Sharma N.B.; Jha B.	“ARCHITECTURAL NARRATIVES: STORYTELLING FOR AUTISM”	2024	0
40	Aziz O.; Farooq M.S.; khelifi A.; Shoaib M.	“Archaeometa: leveraging blockchain for secure and scalable virtual museums in the metaverse”	2024	0

Current scenario

The big, and broad notion of 'neurodiversity in technology', has significantly motivated a shift in societal thinking to one of embracing individuals who would otherwise, carry on carrying the same 'neurodeficiencies' shifting from models like a classic deficit. Instead of finding them as deviates and stressing their faults in it this paradigm focuses their talents in acceptance. This overall acceptance of the neurodiversity movement and these individual’s emphasis on inclusivity and acceptance(Owren & Stenhammer, 2013). This movement has impacted various sectors including education, healthcare, technology, and employment. Advancements in “technology” like implications of many tools and applications have played a very important role in improving the lives and standards of neurodivergent individuals. These tools and applications helped in greater ease of access and neurodivergent individuals are getting the green light day by day. Neurodiversity is accepted differently by different cultured people(Boyd, n.d.) . One side looks at a whole person on the other hand Western ideas focus on medical issues. Research said that is very important to think about social and environmental factors too, not just biology. So it helps other individuals to understand more about neurodivergent individuals. The other thing that supports

neurodiversity is the education system which focuses on the individual's strength. Many technologies like E-learning tools and tech-based platforms, designed with input from neurodivergent people, make learning more personal and effective and it encourages social interaction, breaking down the barriers to inclusion. Nowadays, education systems focus on and provide individual strengths and accommodations for the neurodivergent, and various tools such as e-learning and technology-based learning platforms, developed by neurodivergent individuals ensure a more effective and personalized learning environment (Coplan et al., 2021). These have enhanced academic experiences and developed interaction with society, which have been recognized in a growing degree as contributing value for neurodivergent people. More and more, organizations are focusing on ways to create such inclusive environments. This would include personalized support and developing digital resources that can reduce barriers related to communication, stress management, and much more. Sustainable employment programs and participatory design processes ensure that neurodivergent employees can thrive, while businesses benefit from their unique perspectives and skills (Kirby & Smith, 2021). The main role in shaping the lives of neurodivergent children takes place by families and care providers. They promote therapies targeted at social acceptance and assimilation rather than normalization with their encouragement. This serves the broader purposes of the neurodiversity movement and grassroots community-based initiatives and assists neurodivergent individuals to reach their full potential in a particular environment. Increasingly, the workplace is acknowledging the value that neurodivergent individuals bring to it. Organizations are finding strategies for developing inclusive environments. They do this by offering support that is tailored and utilizing digital tools to manage issues like communication and stress. Neurodiverse employment programs combined with participatory design approaches make it possible for neurodivergent employees to thrive, with business benefits through their unique insights and skills (Maskell, 1999).

5 Limitations of Neurodiversity in Technology

Many technologies have been developed to support neurodiversity and yet there is a set of limitations on research and in the practical implementation of the findings. Indeed, the most salient limitation is in the area of research and its application, which varies widely from region to region (Lollini, 2018). Neurodiversity research is much more common in the United States and the UK, because these countries have better advocacy and a more established legal framework that has led to advancements in research and technological development. These nations have made efforts to integrate neurodiversity into mainstream policy, foster inclusive workplaces, and push for technological advancement. Countries like India face quite a bit of a hurdle due to stigma in society, low awareness levels, and limited resources. In India, neurodiversity is still a relatively new and underexplored concept with fewer initiatives aimed at supporting neurodivergent individuals. This disparity not only slows down the global progress of neurodiversity-focused technologies but also creates inequitable access to such advancements, leaving many neurodivergent individuals without adequate support(Lollini, 2018).

Real-world challenges also persist as regards the design and implementation of technologies meant to support individuals who are neurodivergent. Most of the available tools lack adequate customization to consider the special sensory and cognitive needs of neurodivergent users. For example, extended reality training or educational applications could be over-sensory and become a bad experience for the user if he is sensitive to light or sound. Also, most communication tools are unable to account for non-verbal preferences or other ways of interacting and are therefore ineffective. The most significant challenge still is accessibility, because many technological solutions are created without sufficiently taking into account inclusivity in the design. This lack of foresight eliminates a large part of the neurodivergent populations (Hutson & Hutson, 2023a).

Systemic barriers exacerbate the issues even more. In the workplace, there exists bias in recruitment processes, a lack of appropriate accommodations, and an unaware employer that limits neurodivergent employees' full integration. Neurodivergent recruitment practices always tend to favor neurotypical norms, such as verbal communication and eye contact, to exclude some neurodivergent individuals who may have significant strengths in problem-solving, innovation, and creativity (Kozyreva et al., 2020). Even after getting employed, neurodivergent workers face work environments that do not meet their special needs. Consequently, they have higher rates of unemployment and retain less than their neurotypical counterparts. Systemic failure in support excludes neurodivergent people from organizations, and their abilities aren't able to exhibit in fullness.

In addition to the above factors, ethical considerations add another layer of complexity in taking up neurodiversity-based technologies. Since several assistive technologies collect and store sensitive information related to people's private lives, there is this issue of data privacy and security. Misuse of that same information raises grave ethical concerns about communities that stigmatize or discriminate against neurodivergent members. That would not be good at all when breaches of confidentiality may lead to exploitation or further marginalization of neurodivergent persons in both their private and professional lives. Moreover, the ethical issues related to the change of natural neural functions via devices such as transcranial electrical stimulation are by no means trifling. Such technological advancements have opened personalized options but also present a threat to individuals' autonomy as they tend to create addiction or otherwise reduce the user's sense of control (Safa et al., 2023). Again, the need for equilibrating technological progression with rights and dignity associated with individualism is required

Thirdly, further complicating the adoption process is that the reinforcement of stereotypes through technology and the marginalization of others become easy(Allen, n.d.). For example, neurodivergent behaviors are forced to "normalize" through AI-driven systems, and these may unwittingly promote the prejudices of society regarding what acceptable conduct is. This will undermine the general purpose of neurodiversity advocacy, which is to celebrate and accommodate differences rather than eliminate them. Over-reliance on technology also presents risks in that it may discourage the development of independent coping strategies and human-led support systems that are equally important for neurodivergent individuals (Corrigan & Shapiro, 2010).

This requires a multi-dimensional approach that includes global research, inclusive design, and systemic societal change. Research needs to be expanded into underrepresented regions and from interdisciplinary perspectives, which can help better understand neurodiversity. The societal stigma attached to the conditions has to be diminished through public awareness campaigns undertaken by governments, schools, and organizations, and a training program that increases inclusion (Kaaria & Karemu, 2024). Technological designs must be customized and accessible so that the tools are developed for diverse neurodivergent needs. Involving neurodivergent people in the design process may enhance the applicability and impact of such solutions.

Finally, strong ethical guidelines should be put in place to ensure responsible application of neurodiversity-focused technologies. Such regulations must be incorporated with safeguarding of information, obtaining prior consent, and consequences resulting from the use of this technological intervention. Through encouraging societal changes in accepting neurodiversity as human diversity, we will tap into technology to its maximum potential to enable and include. This overcoming of barriers will not only better the quality of life for neurodivergent individuals but also enrich society with the unique perspectives and talents they bring to the table (Volpone et al., 2022). Together, through technology, there will be a bridge toward equity and opportunity, such that no neurodivergent person would ever miss the boat of the digital revolution.

6 Discussions and Conclusions

This study emphasizes that neurodiversity and technology must be tackled comprehensively and inclusively; so that innovation and inclusion go hand in hand. Such is the only way for technological solutions to work for the populations they are set up to serve. The first step in that direction is to engage the neurodivergent in design and implementation processes. Using their lived experiences and insights, developers can then make tools that are both functional and deeply resonant with the needs of the neurodivergent community. Organizations and schools also play their part in creating such environments available for neurodivergent people. These would include sensory-friendly workplaces, flexible work policies, and module learning that allows for individualized cognitive abilities. All of these measures empower neurodivergent people to be valued, supported, and enabled to contribute significantly in their communities and workplaces.

This, then, requires that the rights and dignity of neurodivergent people be protected through developing sound ethical frameworks as technology keeps advancing. Such frameworks have to be developed taking into account issues surrounding data safety, informed consent, and even unintended consequences such interventions of technology might be fraught with. In such lines, for example, laws must ensure the secured holding of data created or processed by assistive technology. Public campaigns on challenges of stereotypes and the embracing of neurodiversity in human beings also help. With such investments in research and development to advance inclusive technologies, governments, and policymakers should strive to give equal access to regions and

demographics (Orsini, 2012).. In short, it can only be an equalizer in the neurodivergent landscape through collective and concerted efforts by technologists, researchers, policymakers, and neurodivergent communities. That would allow society to step forward into a future where neurodiversity is no longer stigmatized but celebrated as the basis for progress and innovation. It's in the future when neurodivergent are empowered to fulfil their highest aspirations and contribute unique talents and experiences to an inclusive, just society-technology is not a crutch but rather a bridge able to link neurodiverse people to opportunities, to resources, and to the community in ways previously unimaginable.

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