



Accessible Devices and Apps: Financial Affordability and Developmental Challenges for Persons with Visual Disabilities in India

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Abstract

In the 21st century, technological advancements have significantly improved accessibility for persons with visual disabilities in India. Innovations like screen readers and assistive apps have transformed how visually impaired individuals navigate the world. However, in India, where many users come from economically disadvantaged backgrounds, affordability remains a critical barrier.

In India, approximately 4.95 million individuals are blind, with an additional 69.8 million experiencing varying degrees of visual impairment (PCQuest, 2024). Advancements in assistive technologies, such as smart glasses and smartphone applications, have significantly enhanced accessibility for these individuals. However, challenges still remain, particularly concerning the affordability and development of these technologies within the Indian context. This paper examines the financial and developmental obstacles faced by persons with visual disabilities in India, focusing on the accessibility and practicality of assistive devices and applications.

Keywords

Accessibility, screen readers, financial challenges, assistive technology, visual disabilities, NVDA, JAWS,

Introduction:

Assistive technologies have revolutionized the lives of individuals with visual impairments, enabling greater independence and integration into society. In India, the development and distribution of such technologies are crucial, given the substantial population affected by visual disabilities. Despite the potential benefits, the adoption of assistive devices in India remains limited, with access rates as low as 3% in certain regions (YourStory, 2024). As a result, most of them cannot afford the latest cutting-edge innovations.

Financial constraints are a significant barrier to the widespread adoption of assistive technologies. Many devices developed in Western countries are not economically viable for the average Indian consumer (Economic Times, 2017). For instance, while smart glasses have been developed to aid the visually impaired, their high cost often renders them inaccessible. However, local innovations, such as the development of smart glasses such as smarton device priced under ₹20,000, demonstrate India's potential to produce affordable solutions tailored to its unique socio-economic landscape (YourStory, 2024).

Developmental challenges also impede the effective implementation of assistive technologies. These include the need for localization to accommodate and include regional languages and contexts, ensuring usability for individuals with varying degrees of technical proficiency, and the sustainability of production and distribution models. Moreover, infrastructural limitations, particularly in rural areas, further hinder the deployment and utilization of these latest technologies.

This paper aims to explore these financial and developmental challenges in detail, providing insights into the current state of assistive technologies for persons with visual disabilities in India. By analyzing user experiences, developer perspectives, and policy implications, the study seeks to contribute to the ongoing discourse on enhancing accessibility and inclusivity for visually impaired individuals in the Indian context.

Section 2: Historical Context

The evolution of assistive technologies for visually impaired individuals in India reflects a journey from traditional aids to advanced technological solutions. Historically, tools like the white cane have been fundamental in aiding mobility. In recent years, innovations such as the SmartCane—a device enhancing the traditional white cane with ultrasonic obstacle detection—have emerged, exemplifying the integration of technology to improve navigation for the visually impaired (Economic Times, 2017).

The development of assistive technologies in India has been significantly influenced by local innovators and institutions. There are many NGO's and government institutions working in these field. For instance, the National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD) in Dehradun has played a pivotal role in training, research, and the production of Braille literature and assistive devices, contributing to the empowerment of visually impaired individuals across the country (NIEPVD, n.d.).

Despite these advancements and development, challenges persist. The high cost of many assistive devices, often developed in Western contexts, renders them inaccessible to a large segment of the Indian population. However, local manufacturing and innovation have led to the development of more affordable solutions tailored to the socio-economic realities of India. For example, the Smart Vision Gen 2.0, an AI-powered smart glass developed in collaboration with Indian partners, offers functionalities like reading, navigation, and object recognition at a more accessible price point (Vision Aid India, n.d.).

The historical trajectory of assistive technologies in India underscores a transition from reliance on imported solutions to indigenous innovations that address the unique needs and challenges of the Indian

context. This evolution highlights the importance of local development and production in making assistive technologies more accessible and affordable for visually impaired individuals in India.

Section 3: Methodology

While conducting this study we have employs a mixed-methods approach, integrating both qualitative and quantitative data to comprehensively examine the financial and developmental challenges associated with assistive technologies for visually impaired individuals in India.

Data Collection.

1. Surveys and Questionnaires:

- **Participants:** A total of 200 visually impaired individuals across various regions of India were surveyed to gather insights into their experiences with assistive technologies.
- **Instrument:** A structured questionnaire was designed, encompassing sections on device usage, affordability, accessibility, and perceived challenges.

2. Interviews:

- **Participants:** In-depth interviews were conducted by us with 20 stakeholders, including developers of assistive technologies, policymakers, and representatives from non-governmental organizations (NGOs) working in the field of visual impairment.
- **Focus:** These interviews were aimed to explore the developmental challenges, policy implications, and sustainability concerns related to assistive technologies in India.

3. Secondary Data Analysis:

- **Sources:** Existing literature, reports from governmental and non-governmental organizations, and academic studies were reviewed to contextualize the findings and provide a comprehensive overview of the current landscape of assistive technologies in India.

Data Analysis

- **Quantitative Analysis:** Survey data were analyzed using statistical methods to identify trends, correlations, and significant factors influencing the adoption and usage of assistive technologies among visually impaired individuals.
- **Qualitative Analysis:** Interview transcripts were thematically analyzed to extract key themes and insights regarding developmental challenges, user experiences, and policy considerations.

Ethical Considerations

- **Informed Consent:** All participants were informed about the purpose of the study and provided consent prior to participation.

- Confidentiality: Participant anonymity was ensured by assigning unique identifiers and securely storing data.
- Approval: The study protocol was reviewed and approved by the Institutional Review Board (IRB) of [D.K. college].

Limitations

- Sample Representation: While efforts were made to include a diverse participant pool, the sample may not fully represent the entire population of visually impaired individuals in India.
- Self-Reported Data: The reliance on self-reported data may introduce biases related to participant perception and recall.

Section 4: Financial Challenges and Affordability

Introduction:

Financial challenges remain one of the most significant barriers to the widespread adoption of assistive technologies by visually impaired individuals in India. The high cost of devices, combined with economic disparities, limits accessibility, particularly in rural and economically disadvantaged areas. While there are efforts to provide cost-effective solutions, the existing gaps highlight the need for targeted interventions and sustainable support systems.

Many assistive devices for visually impaired individuals are unaffordable due to their high manufacturing and development costs. For example, JAWS, a leading screen reader, costs \$95 annually for a home license or \$1200 for professional use (Freedom Scientific, n.d.). Similarly, advanced tools like Envision Glasses are priced between ₹149,000 and ₹266,000, making them inaccessible to the majority of Indian users. Local innovations have attempted to address these challenges. Devices like SmartCane, developed in India, are priced at ₹3500, offering an affordable alternative to traditional white canes with added functionality, such as ultrasonic obstacle detection (Economic Times, 2017). Similarly smarton glass and Dhrishti device with vision capabilities have also tried to bridge the gap. While these devices are cost-effective, limited awareness and adoption hinder their widespread impact.

Interviews with users reveal that affordability is a critical factor when deciding to adopt new technologies. Many visually impaired individuals prioritize basic devices like mobile phones with screen reader functionalities over specialized tools due to cost considerations. For instance, one respondent highlighted that while advanced tools like Orbit Reader 20 (₹45,000) are beneficial for education and employment, maintenance costs ranging from ₹1000 to ₹15,000 further exacerbate affordability issues. However, those who rely mainly on braille definitely purchased the device for their daily use.

Users also rely on funding support from NGOs or CSR initiatives. However, the availability of such assistance is limited, and government subsidies often fail to cover the full cost of assistive devices. This situation leaves many visually impaired individuals dependent on outdated or suboptimal solutions.

The Indian government has initiated programs through institutions like the National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD), distributing subsidized devices such as PlexTalk DAISY players in schools and colleges. Other organization also do this types of inniciatives tomake the devices affordable. Additionally, CSR initiatives, such as those supporting the development of Nobaflix (an accessible OTT platform), have demonstrated the potential for private partnerships to bridge the affordability gap.

To overcome affordability challenges, several strategies are proposed:

1. **Scaling Local Manufacturing:** Expanding the production of affordable devices like SmartCane and Kibo Access will reduce dependency on imported solutions. There is urjent need to scale up local manufacturing
2. **Policy Support:** Introducing comprehensive subsidies for assistive devices under government welfare programs and ensuring their timely distribution. Government should bring a dedicated policy for visually impaired users.
3. **CSR and Public-Private Partnerships:** Encouraging collaborations between private organizations and NGOs to fund and distribute assistive technologies widely. This can result great improvement towards the affordability gap.

In conclusion, affordability remains a significant barrier to the adoption of assistive technologies for visually impaired individuals in India. While localized innovations and institutional support have shown promise, sustained efforts are needed to scale production, enhance subsidies, and foster collaborations for long-term impact.

Section 5: Developmental Challenges in Assistive Technologies

Introduction

While assistive technologies have transformed the lives of visually impaired individuals, their development faces significant challenges in India. These obstacles stem from the need for user-centric designs, regional adaptability, and technological scalability. Additionally, sustainability in funding and production poses long-term barriers to widespread adoption and innovation.

Key Challenges in Development

1. Design and Usability:-

Devices like the Orbit Reader 20, which are popular among visually impaired professionals, often lack user-friendly features. For instance, its single-line Braille display slows reading efficiency, as highlighted by several respondents in interviews. Users frequently express the need for devices that can display more content at once or provide seamless integration with other technologies.

2. Localization and Language Adaptability:-

Many assistive tools, such as NVDA, support Indian languages through plugins, but accuracy and functionality remained inconsistent compared to English. For example, while reading Hindi PDFs, users reported issues with NVDA and other screen readers, which hinder productivity.

3. Sustainability of Funding Models:-

Open-source tools like NVDA rely on donations and corporate sponsorships. While this model provides free access, it leaves the technology vulnerable to funding shortages, which can delay updates and reduce effectiveness. Commercial products like JAWS are highly efficient but unaffordable for most users without subsidies.

4. Rural Accessibility and Connectivity Issues:-

Limited internet connectivity in rural areas restricts the use of advanced assistive tools that rely on cloud-based functionalities. For instance, apps like Envision AI, which depend on stable connections for real-time image recognition, face usability issues in low-bandwidth environments.

5. Affordability of Cutting-Edge Innovations:-

Devices such as Envision Glasses and Kibo Access, priced at ₹1.5 lakh and ₹27,000 respectively, are out of reach for many potential users. Although subsidies from organizations like VOSAP (Voice of Specially Abled People) help reduce costs, accessibility and distribution remains limited.

Proposed Solutions

1. User-Centric Design Approaches:-

Developers must incorporate user feedback to ensure devices are practical and accessible. Suggestions include increasing Braille display size which can read a paragraph and enhancing software compatibility with Indian regional languages.

2. Localization of Technology:-

Partnerships with regional language experts can improve the accuracy of screen readers and text-to-speech systems. Additionally, expanding the scope of OCR (optical character recognition) tools to support handwritten and regional scripts can increase their utility.

3. Public-Private Partnerships:-

Collaborative efforts between the government, NGOs, and private companies can provide sustainable funding for assistive technology research and production. For instance, initiatives like Trestle Labs' Kibo Access leverage such partnerships to subsidize devices by up to 90%. With the help of corporate donations they are trying to reach school childrens.

4. Technological Innovation and Simplification:-

Simplifying user interfaces and integrating emerging technologies like AI and machine learning can reduce the learning curve. For example, incorporating AI-based scene descriptions and gesture recognition in apps and devices enhances usability for visually impaired individuals a lot.

Conclusion

The developmental challenges in assistive technologies reflect broader systemic issues, including funding limitations, regional disparities, and usability concerns. However, addressing these challenges through localized solutions, user engagement, and collaborative funding models can pave the way for inclusive and accessible innovation in India.

Section 6: Practical Utility and User Feedback

Introduction

The practical utility of assistive technologies for visually impaired individuals extends beyond basic accessibility, influencing education, employment, and social participation. Feedback from users underscores the critical role of these technologies in fostering independence while highlighting gaps that need to be addressed for improved utility.

Key Findings from User Feedback

1. Ease of Use and Training Needs

- Users reported that while technologies like JAWS and NVDA are indispensable, they have a steep learning curve, especially for first-time users who are using this technology.
- Many users learn through peer support or experimentation rather than formal training, which can lead to inconsistent usage patterns. Suggestions include integrating audio manuals or tutorials directly into devices and apps.

2. Integration into Daily Life

- Screen readers and apps like Envision AI have transformed how users access information, such as reading text and recognizing objects. However, limitations in features like handling regional language texts and accuracy in image descriptions were frequently mentioned in the interview.
- Devices like the Orbit Reader are valued for their note-taking and Braille display functionalities but are limited by their one-line display, slowing down reading efficiency.

3. Accessibility Gaps

- Navigation tools, such as SmartCane, are appreciated for their innovation but criticized for inaccurate vibrations and lack of reliability in crowded environments.

- Mobility apps often fail to address challenges like uneven footpaths and the absence of tactile markers in urban areas, further complicating independent navigation.

4. User Preferences

- Many users prioritize affordability and utility over advanced features. For instance, Android devices with TalkBack are preferred by students due to their lower cost, while professionals lean towards Apple devices with VoiceOver for their seamless integration and advanced functionality such as voice over.

Recommendations from Users

1. Feature Enhancements

- Users advocate for AI-powered tools capable of detailed scene descriptions, including color recognition, facial expressions, and text reading across multiple languages.
- NVDA and JAWS should enhance support for regional language PDFs, ensuring inclusivity for non-English users.

2. Focus on Mobility Solutions

- Develop smarter, more reliable navigation aids, such as wearable devices with improved object recognition and path guidance. These should address real-world challenges, including uneven terrains and crowded environments.

3. Affordability and Subsidies

- Many users stressed the need for affordable pricing models or financial assistance through government and CSR initiatives. Suggestions include subsidized prices for students and tiered subscription plans for advanced features.

4. Training and Support Infrastructure

- Formal training programs, accessible both online and offline, can help users maximize the utility of their assistive devices. Establishing community support groups would also facilitate peer-to-peer learning.

Conclusion

User feedback highlights the transformative impact of assistive technologies while identifying critical areas for improvement. Addressing these concerns—through enhanced features, affordable pricing, and structured support systems—can significantly improve the practical utility of these technologies in daily life.

Section 7: Policy Implications and Recommendations

Introduction

The integration of assistive technologies into the lives of visually impaired individuals in India requires robust policy support. Government intervention, combined with public-private partnerships, can bridge existing gaps in accessibility, affordability, and usability. This section explores current policies and proposes actionable recommendations to create an inclusive ecosystem for assistive technologies.

Current Policy Landscape

1. Government Initiatives

- Programs such as Accessible India Campaign (Sugamya Bharat Abhiyan) aim to enhance physical and digital accessibility for persons with disabilities. However, the scope of these initiatives often excludes advanced assistive technologies like smart glasses and Braille displays.
- The National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD) and other organizations facilitates training and provides subsidized devices, but coverage is limited due to budget constraints.

2. Challenges in Policy Implementation

- Lack of Awareness: Many visually impaired individuals are unaware of available subsidies and programs. The informations are not able to reach in the rural places.
- Urban-Rural Divide: Policies often fail to address accessibility challenges unique to rural areas, where infrastructure and internet connectivity are limited. Therefore, the rural urban divide is still visible in our analyses.

3. CSR and NGO Contributions

- Corporate Social Responsibility (CSR) initiatives, such as Nobaflix's subsidized pricing model for visually impaired users, demonstrate the potential of private-sector involvement. However, these efforts remain fragmented and lack scalability.

Policy Recommendations

1. Expanding Subsidies

- Increase financial support for assistive devices through government programs, ensuring subsidies cover advanced technologies like Orbit Reader and Envision Glasses and other relevant devices.

- Introduce tax incentives for manufacturers and developers of assistive technologies to encourage local production.

2. Public Awareness Campaigns

- Launch nationwide awareness campaigns about the availability of assistive devices, government schemes, and NGO support. Use regional languages to ensure wider reach and inclusivity.

3. Enhancing Infrastructure

- there are urgent need to Improve digital infrastructure, particularly in rural areas, to support cloud-based assistive tools. Introduce tactile paths, Braille signage, and audio navigation systems in public spaces as mandated by accessibility laws.

4. Encouraging Innovation through Funding

- Establish innovation grants for startups developing affordable assistive technologies. Collaborate with research institutions to localize international technologies for the Indian context.

5. Strengthening Public-Private Partnerships

- Foster partnerships between the government, private organizations, and NGOs to expand the reach of affordable assistive technologies. For instance, joint initiatives could fund the distribution of low-cost devices in underserved regions.

6. Regular Policy Monitoring

- Implement a monitoring framework to evaluate the effectiveness of existing policies and identify areas for improvement. Involve visually impaired individuals in policy reviews to ensure their needs and expectations are met.

Conclusion

To achieve a truly inclusive society, policy frameworks must evolve to address the unique challenges faced by visually impaired individuals in India. By expanding subsidies, improving infrastructure, fostering innovation, and strengthening partnerships, the government and private sector can collaboratively create a sustainable ecosystem for assistive technologies.

Section 8: Conclusion and Future Directions

Conclusion

The landscape of assistive technologies for visually impaired individuals in India is evolving, driven by innovations that address specific needs for accessibility and independence. However, significant challenges

remain, particularly in affordability, infrastructure, and user-centric design. The insights gathered from users and developers highlight the need for a multi-faceted approach to overcome these barriers.

The interplay between financial constraints, developmental challenges, and policy gaps underlines the importance of localized solutions. Innovations like SmartCane , nobaflix and Kibo Access have demonstrated that affordable and effective technologies are possible within the Indian context. Yet, scaling these innovations to reach wider audiences remains a critical issue which needs to be fixed.

This study underscores the transformative potential of assistive technologies when supported by robust policy frameworks, sustainable funding, and collaborative efforts between stakeholders. By addressing the identified challenges, India can pave the way for an inclusive society where visually impaired individuals can fully participate in education, employment, and social activities.

Future Directions

1. Technological Advancements

- Emerging technologies such as artificial intelligence, augmented reality, and machine learning offer immense potential for assistive solutions. Future innovations could include advanced wearable devices capable of real-time scene interpretation, voice-guided navigation, and multi-language support which can be used in their day-to-day life.

2. Local Innovation and Manufacturing

- Encouraging local production of assistive devices can reduce costs and increase availability. Government incentives for research and development in this field can further promote innovation tailored to India's socio-economic realities.

3. Comprehensive Policy Implementation

- Policies like the Accessible India Campaign should expand their scope to include advanced assistive technologies and address regional disparities in implementation. A more inclusive approach, with input from visually impaired individuals, is essential to make this success.

4. Community Engagement

- Building awareness and fostering community involvement through training programs, peer networks, and support systems can help users maximize the utility of assistive devices into their daily life.

5. Global Collaboration

- Partnering with international organizations and leveraging global expertise can help India adopt best practices in assistive technology development and implementation. Collaborative research and cross-border funding initiatives can enhance the availability of cutting-edge solutions.

6. Long-Term Monitoring and Evaluation

- Establishing mechanisms to monitor the impact of assistive technologies on visually impaired individuals can provide valuable insights for iterative improvements. Regular feedback loops between users, developers, and policymakers are crucial for sustained progress.

Final Thoughts

The journey toward accessibility and inclusion is an ongoing process. While India has made strides in developing and adopting assistive technologies, the path ahead demands greater collaboration, innovation, and policy coherence. By prioritizing the needs of visually impaired individuals and addressing systemic challenges, the country can set a global benchmark in creating an inclusive society.

Bibliography

- Apple Inc. (n.d.). VoiceOver Accessibility. Retrieved January 11, 2025, from <https://www.apple.com/accessibility>
- Economic Times. (2017). How a bunch of Indian tech startups hope to transform the assistive technology space. Retrieved from <https://economictimes.indiatimes.com/small-biz/startups/fledgling-assistive-technology-space-gets-help-from-startups/articleshow/59100127.cms>
- Envision. (n.d.). Envision - Perceive Possibility. Retrieved January 11, 2025, from <https://www.letsenvision.com/>
- Freedom Scientific. (n.d.). JAWS Screen Reader. Retrieved January 11, 2025, from <https://www.freedomscientific.com/products/software/jaws/>
- Google. (n.d.). TalkBack Accessibility Help. Retrieved January 11, 2025, from <https://support.google.com/accessibility>
- Kumari, N. (2019). Karmic Philosophy and the Model of Disability in Ancient India. Shanlax International Journal of Arts, Science and Humanities, 7(1), 39-43. <https://doi.org/10.34293/sijash.v7i1.531>
- Nair, A. (2017). 'They Shall See His Face': Blindness in British India, 1850–1950. Medical History, 61(2), 181-199. <https://doi.org/10.1017/mdh.2017.3>
- National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD). (n.d.). About Us. Retrieved from <http://nivh.gov.in/index.php>
- NV Access. (n.d.). About NV Access. Retrieved January 11, 2025, from <https://www.nvaccess.org/about-nv-access/>

- Orbit Research. (n.d.). Orbit Reader 20. Retrieved January 11, 2025, from <https://www.orbitresearch.com/product/orbit-reader-20/>
- Trestle Labs. (n.d.). Kibo | Trestle Labs: Making content digitally inclusive. Retrieved January 11, 2025, from <https://www.trestlelabs.com/>
- VOSAP. (n.d.). Voice of Specially Abled People: Bridging the Gap for Accessibility. Retrieved from <https://www.vosap.org>
- YourStory. (2024). How is India making assistive technology affordable and accessible?. Retrieved from <https://yourstory.com/socialstory/2024/12/india-making-assistive-technology-accessible>