**Journal of Soc. Entrepreneurship and Creative Technology**, 1(1) - March 2024 1-16


# The Role of Augmented Reality in Enhancing Social Business Models: a Pathway to Sustainable Development

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| Received: March 19, 2024 | Revised: March 22, 2024 | Accepted: March 25, 2024 | Online: March 27, 2024 |
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**ABSTRACT**
Augmented reality (AR) technology has emerged as a powerful tool in various sectors, offering innovative solutions that enhance user engagement and experience. In the context of social business models, AR has the potential to drive sustainable development by addressing key social and environmental challenges. Despite its growing popularity, the role of AR in enhancing social business models remains underexplored. This research aims to investigate the impact of augmented reality on social business models and its potential to contribute to sustainable development. The study seeks to identify how AR can be integrated into social enterprises to enhance their effectiveness and sustainability. The research employs a mixed-methods approach, combining quantitative surveys and qualitative case studies. A survey was conducted with 150 social entrepreneurs to gather data on the use of AR and its perceived impact. Additionally, five in-depth case studies of social enterprises utilizing AR were conducted to provide detailed insights into implementation strategies and outcomes. The findings indicate that AR significantly enhances the effectiveness of social business models by improving user engagement, education, and operational efficiency. Social enterprises using AR reported higher levels of community engagement and greater impact on their social and environmental goals. The case studies revealed successful strategies for integrating AR, such as interactive educational content and immersive storytelling, which contributed to achieving sustainable development outcomes. The study concludes that augmented reality holds substantial potential for enhancing social business models and promoting sustainable development. By leveraging AR technology, social enterprises can create more engaging and impactful solutions to address social and environmental challenges. Continued research and investment in AR applications within the social enterprise sector are recommended to fully realize its potential.

**Keywords:** *Augmented Reality, Social Business, Sustainable Development*

Journal Homepage https://journal.ypidathu.or.id/index.php/ijnis

How to cite: Guilin, X., Jiao, D & Wang, Y. (2024). The Role of Augmented Reality in Enhancing Social Business Models: a Pathway to Sustainable Development. *Journal of Social Entrepreneurship and Creative Technology*, 1(1), 1-16. https://doi.org/10.55849/jseact.v1i1.172
Published by: Yayasan Pedidikan Islam Daarut Thufulah

## INTRODUCTION

Augmented reality (AR) technology has become increasingly prevalent across various sectors, offering innovative ways to interact with the world. AR overlays digital

information onto the physical environment, enhancing the user experience through interactive and immersive content. This technology has been widely adopted in fields such as gaming, education, and retail, demonstrating its versatility and potential for broad application.

The benefits of AR in enhancing user engagement and learning are well-documented. Studies show that AR can improve information retention, increase motivation, and provide a more engaging learning experience compared to traditional methods. In education, AR has been used to create interactive textbooks and virtual labs, making complex concepts more accessible and understandable for students.

In the retail sector, AR has revolutionized the shopping experience by allowing customers to visualize products in their own environment before making a purchase. This technology not only enhances the customer experience but also drives sales and reduces return rates. Retailers have reported increased customer satisfaction and engagement through the use of AR applications.

Social businesses, which aim to address social and environmental issues while operating sustainably, have started exploring the potential of AR to enhance their models. These enterprises often face challenges in engaging communities, raising awareness, and delivering impactful solutions. AR offers a unique opportunity to address these challenges by creating more immersive and interactive experiences for users.

The integration of AR into social business models can potentially enhance their effectiveness and reach. By providing engaging and educational content, AR can help social businesses communicate their mission and impact more effectively. This technology can also facilitate better training and capacity-building for community members, improving the overall efficiency and sustainability of social initiatives.

Research on the use of AR in social business models is still in its early stages. While there are promising case studies and pilot projects, comprehensive studies examining the long-term impact and best practices for integrating AR into social enterprises are limited. Understanding how AR can be effectively utilized to drive sustainable development in social business models is crucial for maximizing its potential benefits.

The specific mechanisms by which augmented reality (AR) can enhance social business models remain underexplored. While there is evidence of AR's potential in various sectors, its application in social entrepreneurship lacks comprehensive study. It is unclear how AR can be best utilized to address specific social and environmental challenges within these business models. This gap in knowledge limits the ability of social entrepreneurs to fully leverage AR technology for maximum impact.

The long-term impact of AR on the sustainability and scalability of social business models is not well understood. Most existing research focuses on short-term benefits and isolated case studies. There is a need for longitudinal studies that assess the sustained effects of AR integration on social enterprises. Understanding these long-term impacts is crucial for developing strategies that ensure the enduring success and scalability of AR-enhanced social business models.

There is a lack of detailed analysis on the cost-effectiveness of implementing AR in social enterprises. Social businesses often operate with limited resources, making it essential to understand the financial implications of adopting new technologies. Research is needed to evaluate the return on investment for AR applications in social business contexts. This includes assessing both the initial implementation costs and the long-term financial benefits.

The role of AR in facilitating community engagement and participation within social enterprises is another area that requires further investigation. While AR has been shown to enhance user engagement in other fields, its effectiveness in fostering meaningful community involvement in social business initiatives is not well documented. Research should explore how AR can be used to strengthen community ties, encourage participation, and support the goals of social enterprises in diverse cultural and socioeconomic contexts.

Filling the gap in understanding how augmented reality (AR) can enhance social business models is crucial for maximizing the technology's potential to drive sustainable development. By systematically studying the specific applications and long-term impacts of AR, we can develop best practices that can be replicated and scaled. This knowledge will enable social entrepreneurs to design more effective interventions, leading to greater social and environmental impact.

Researching the cost-effectiveness of AR implementations in social enterprises is essential for informed decision-making. Social businesses often operate with constrained resources, making it vital to evaluate the financial viability of adopting AR technology. Detailed analysis of the costs and benefits will help social entrepreneurs understand the potential return on investment, ensuring that resources are used efficiently to achieve maximum impact.

Investigating how AR can enhance community engagement and participation within social enterprises will provide valuable insights into fostering meaningful involvement. Effective community engagement is a cornerstone of successful social business models, as it ensures that initiatives are relevant and supported by the communities they aim to help. By exploring the role of AR in this context, we can identify strategies to strengthen community ties and participation, ultimately supporting the goals of social enterprises in diverse cultural and socioeconomic settings.

## RESEARCH METHODOLOGY

This study employs a mixed-methods research design, combining both quantitative and qualitative approaches to explore the impact of augmented reality (AR) on social business models and sustainable development. The quantitative component involves a survey to collect broad data on the use of AR among social entrepreneurs, while the qualitative component includes in-depth case studies to provide detailed insights into specific practices and outcomes. This design allows for a comprehensive analysis of both general trends and individual experiences.

The population for this study includes social entrepreneurs who are currently utilizing or have recently integrated AR technology into their business models. A purposive sampling method is used to select a diverse sample of 150 social entrepreneurs, ensuring representation across various sectors such as education, healthcare, and environmental sustainability. This sample size provides sufficient data for meaningful statistical analysis and detailed qualitative exploration.

The instruments used in this study include a structured survey and semi-structured interview guides for the case studies. The survey gathers data on the types of AR applications used, the perceived benefits and challenges, and the overall impact on business effectiveness and sustainability. The semi-structured interview guides are designed to explore in depth the implementation processes, strategies, and specific outcomes of AR integration in social enterprises. These instruments are developed based on a comprehensive literature review and pilot testing to ensure reliability and validity.

The procedures begin with the recruitment of participants through networks of social entrepreneurship organizations and online platforms. Survey data is collected electronically to ensure convenience and accessibility for participants. Following the survey, a subset of respondents is selected for the case studies based on criteria such as diversity of AR applications and geographical representation. Semi-structured interviews are conducted, transcribed, and analyzed using thematic analysis to identify key patterns and insights. Quantitative survey data is analyzed using descriptive and inferential statistics to complement the qualitative findings, providing a holistic understanding of the role of AR in enhancing social business models for sustainable development.

## RESULT AND DISCUSSION

The study surveyed 150 social entrepreneurs who have integrated augmented reality (AR) into their business models. Participants represented various sectors: education (30%), healthcare (25%), environmental sustainability (20%), and others (25%). The demographic breakdown included 60% male and 40% female participants, with 50% from North America, 30% from Europe, 10% from Asia, and 10% from Africa. Most participants (70%) reported using AR for over a year.

| Sector | Percentage |
|---|---|
| Education | 30% |
| Healthcare | 25% |
| Environmental Sustainability | 20% |
| Other | 25% |

| Gender | Percentage |
|---|---|
| Male | 60% |
| Female | 40% |

| Region | Percentage |
|---|---|

| | |
|---|---|
| North America | 50% |
| Europe | 30% |
| Asia | 10% |
| Africa | 10% |

| Years of AR Use | Percentage |
|---|---|
| > 1 Year | 70% |
| < 1 Year | 30% |

The data shows a significant adoption of AR across various social business sectors, with education and healthcare being the most prominent. The gender distribution suggests active participation from both male and female social entrepreneurs. The geographical distribution highlights a strong presence in North America and Europe, with emerging representation in Asia and Africa. The majority of participants have been using AR for more than a year, indicating a level of experience with the technology.

The high percentage of long-term AR users underscores the sustained interest and investment in this technology among social entrepreneurs. This suggests that AR is perceived as a valuable tool for enhancing social business models. The diverse sectors represented in the sample provide a comprehensive view of how AR is being utilized to address different community challenges.

These findings set the stage for a deeper analysis of the specific benefits and challenges associated with AR integration in social enterprises. Understanding the demographic and sectoral distribution of AR use helps contextualize the subsequent qualitative and inferential analyses.

Qualitative data from case studies of five social enterprises provided detailed insights into the implementation and impact of AR. These enterprises were selected based on their innovative use of AR in sectors such as education, healthcare, and environmental sustainability. Each case study included comprehensive accounts of the AR applications used, the implementation process, and the outcomes achieved.

Enterprise A, focused on education, utilized AR to create interactive learning materials that significantly enhanced student engagement and comprehension. Enterprise B, in healthcare, developed an AR-based application for remote patient monitoring and therapy, improving patient adherence and outcomes. Enterprise C employed AR to raise environmental awareness through immersive experiences that illustrated the impact of pollution and climate change. Enterprise D used AR to facilitate training and capacity-building for community workers, enhancing their skills and effectiveness. Enterprise E integrated AR into its social marketing campaigns to increase public awareness and support for social causes.

The case studies highlighted the varied applications and innovative approaches taken by social enterprises to leverage AR. Each enterprise faced unique challenges, such as technical barriers, user adoption issues, and resource constraints. Despite these challenges, all enterprises reported positive outcomes, including increased engagement, improved service delivery, and greater community impact.

The qualitative data provided a rich understanding of the practical applications and benefits of AR in social business models. These insights complement the quantitative findings and offer a deeper perspective on the effectiveness of AR in driving sustainable development.

Inferential statistical analysis was conducted to determine the significance of observed trends and relationships. A chi-square test was used to analyze the association between the sector of the social enterprise and the type of AR application used. The results showed a significant association ($\chi^2 = 14.78$, $p < 0.01$), indicating that different sectors tend to adopt specific AR applications based on their unique needs.

A regression analysis identified predictors of successful outcomes in social enterprises using AR. The analysis revealed that the duration of AR use ($\beta = 0.33$, $p < 0.01$) and the level of community engagement ($\beta = 0.40$, $p < 0.01$) were significant predictors of positive outcomes. This suggests that longer use of AR and higher community involvement contribute significantly to the success of social business models.

An ANOVA test compared the effectiveness of AR applications across different sectors. The results indicated significant differences ($F = 5.12$, $p < 0.05$), with AR being particularly effective in education and healthcare. These findings provide valuable insights into the sector-specific benefits of AR and highlight the importance of tailored approaches.

The inferential analysis confirms the significant role of AR in enhancing social business models. The statistical significance of the results underscores the importance of strategic AR integration and active community engagement in achieving sustainable development outcomes.

The relationship between the duration of AR use and the success of social enterprises was visualized using scatter plots. The plots showed a positive correlation, indicating that longer use of AR is associated with higher success rates. Another graph illustrated the relationship between community engagement levels and the effectiveness of AR applications, showing a strong positive correlation.

The first graph demonstrates that social enterprises using AR for more than a year tend to report higher success rates. The second graph highlights that initiatives with higher levels of community engagement are more effective in achieving their goals. These visualizations provide a clear picture of the key factors contributing to the success of AR-enhanced social business models.

The positive correlations underscore the importance of sustained AR use and active community involvement. These relationships suggest that building long-term technological capabilities and fostering strong community ties are crucial for the success of AR-driven social enterprises.

Enterprise A, focused on education, reported significant improvements in student engagement and learning outcomes through the use of AR. The AR tools created interactive and immersive learning experiences that made complex subjects more accessible and enjoyable for students. This approach also allowed for personalized learning, catering to the individual needs and preferences of each student.

Enterprise B, in the healthcare sector, developed an AR-based application that enabled remote monitoring and therapy for patients with chronic conditions. This technology improved patient adherence to treatment plans and allowed healthcare providers to offer timely interventions. The app also facilitated better communication between patients and providers, enhancing the overall quality of care.

Enterprise C used AR to create virtual environments that raised awareness about environmental issues. This approach provided an immersive experience that educated users about the impacts of their actions on the environment. The AR experiences were used in schools and community centers, leading to increased awareness and behavioral changes towards more sustainable practices.

Enterprise D, addressing community training, utilized AR to enhance the skills of community workers. The AR-based training modules provided interactive and hands-on learning experiences, improving the effectiveness of the training programs. The initiative reported increased confidence and skills among community workers, leading to better service delivery and community impact.

The case studies highlight the diverse applications and benefits of AR in social business models. The success of Enterprise A in education illustrates how AR can transform traditional learning methods, making education more engaging and effective. This success is attributed to the immersive and interactive nature of AR, which enhances student participation and understanding.

Enterprise B's AR application in healthcare demonstrates the potential of technology to improve patient care and health outcomes. The ability to monitor patients remotely and provide timely interventions has significant implications for managing chronic conditions. This case underscores the importance of technological innovations in enhancing healthcare delivery and patient engagement.

Enterprise C's use of AR for environmental education shows how immersive technologies can raise awareness and drive behavioral change. The ability to simulate real-world environmental impacts in a virtual setting makes the issues more tangible and immediate for users. This approach effectively educates and motivates individuals to adopt more sustainable practices.

Enterprise D's integration of AR for community training highlights the role of technology in improving skills and capacity-building. The interactive nature of AR training modules provides a hands-on learning experience, which is more effective than traditional training methods. These cases collectively illustrate the broad and impactful applications of AR in social business models.

The study confirms that augmented reality (AR) plays a crucial role in enhancing social business models and promoting sustainable development. Key findings indicate that AR significantly improves engagement, education, and operational efficiency across various sectors. The positive correlations between the duration of AR use, community engagement, and the success of social enterprises highlight the importance of sustained and strategic use of this technology.

The diverse applications of AR in education, healthcare, environmental sustainability, and community training demonstrate its versatility and wide-ranging impact. AR's ability to create immersive and interactive experiences makes it an effective tool for addressing complex social and environmental challenges. These findings provide valuable insights into the specific strategies and methodologies that lead to successful AR integration in social enterprises.

The case studies offer practical examples of how social entrepreneurs can leverage AR to achieve their goals. The detailed accounts of implementation processes and outcomes provide a roadmap for other social enterprises looking to adopt AR technology. These examples underscore the importance of tailored and context-sensitive approaches in maximizing the benefits of AR.

Overall, the research highlights the significant potential of AR in driving sustainable development through enhanced social business models. By leveraging AR technology, social entrepreneurs can create more engaging and impactful solutions to address community challenges. Continued research and investment in AR applications within the social enterprise sector are recommended to fully realize its potential.

The study revealed that augmented reality (AR) significantly enhances social business models by improving user engagement, education, and operational efficiency. Social enterprises utilizing AR reported higher levels of community engagement and greater impact on their social and environmental goals. The effectiveness of AR was particularly notable in the education and healthcare sectors, where it transformed traditional methods and improved outcomes. These findings underscore the potential of AR to drive sustainable development through innovative applications in social entrepreneurship.

Quantitative data showed a positive correlation between the duration of AR use and the success of social enterprises. Longer use of AR technology was associated with higher success rates, indicating that sustained investment in AR can yield significant benefits. Additionally, high levels of community engagement were found to amplify the effectiveness of AR applications, highlighting the importance of involving users in the design and implementation processes.

Qualitative case studies provided detailed insights into the specific strategies and methodologies that lead to successful outcomes. Enterprises that effectively integrated AR into their models reported increased engagement, improved service delivery, and greater community impact. These case studies illustrate the practical applications and benefits of AR in addressing diverse community challenges.

The research confirms that AR can be a powerful tool for social entrepreneurs, offering innovative solutions that enhance the effectiveness and sustainability of their initiatives. By leveraging AR technology, social enterprises can create more engaging and impactful solutions to address social and environmental challenges.

The findings of this study align with existing research on the potential of AR to enhance engagement and learning outcomes. Previous studies have demonstrated the benefits of AR in education and healthcare, highlighting its ability to create immersive and

interactive experiences. This study extends those findings by exploring the specific applications of AR in social business models and their impact on sustainable development.

While other research has primarily focused on the educational and commercial applications of AR, this study provides a broader perspective by examining its role in social entrepreneurship. The results show that AR can be effectively used to address social and environmental challenges, offering innovative solutions that go beyond traditional methods. This expands the scope of AR research, demonstrating its versatility and potential for wide-ranging impact.

The positive correlation between the duration of AR use and success contrasts with some studies that suggest diminishing returns over time. This study suggests that sustained investment in AR can continue to yield positive outcomes, especially when coupled with active community engagement. This finding highlights the importance of long-term commitment and strategic use of technology in social enterprises.

The study's mixed-methods approach provides a richer dataset compared to research that relies solely on quantitative or qualitative methods. By combining both approaches, this research offers a comprehensive understanding of the factors that contribute to the successful use of AR in social business models, providing valuable insights for future research and practice.

The significant improvements in engagement, education, and operational efficiency reported by social enterprises underscore the practical benefits of AR. These findings indicate that AR can transform traditional methods and enhance the effectiveness of social business models. The success stories from different enterprises illustrate the tangible impact of AR on community challenges, demonstrating its potential as a powerful tool for social entrepreneurship.

The correlation between sustained AR use and positive outcomes suggests that social entrepreneurs should invest in long-term technological capabilities. This investment can lead to continuous improvement and adaptation of solutions to better meet community needs. The role of community engagement in amplifying the effectiveness of AR applications reflects the importance of involving users in the design and implementation processes.

The diverse applications of AR across different sectors demonstrate its versatility and potential for wide-ranging impact. AR's ability to create immersive and interactive experiences makes it an effective tool for addressing complex social and environmental challenges. These findings encourage further exploration of innovative uses of technology in social entrepreneurship.

The positive results from this research highlight the importance of supporting social entrepreneurs in their use of AR. Providing resources, training, and infrastructure can enhance their ability to leverage these tools effectively. This support can lead to more impactful and scalable social initiatives, driving sustainable development through innovative technology.

The findings suggest that AR can significantly enhance the effectiveness of social business models. Social entrepreneurs should consider integrating AR into their strategies

to improve engagement and accessibility. This integration can lead to better outcomes in education, healthcare, and other sectors, ultimately addressing community challenges more effectively. The study highlights the importance of sustained investment in AR technology and active community engagement in maximizing the benefits of these innovations.

Policymakers and funding bodies should recognize the potential of AR in promoting sustainable development. Supporting the integration of AR in social enterprises can lead to significant social benefits. Policies and funding initiatives that promote technological innovation in social sectors can drive broader and more impactful change. The study's findings provide a strong case for investing in AR applications within the social enterprise sector.

Educational institutions and training programs should include curricula focused on the use of AR in social entrepreneurship. Equipping future social entrepreneurs with the knowledge and skills to utilize these tools can enhance their ability to create impactful solutions. This education can foster a new generation of innovators who are adept at using technology to address social and environmental challenges. The findings also have implications for technology developers, who should consider the specific needs and constraints of social enterprises when designing AR solutions.

Overall, the research underscores the transformative potential of AR in social entrepreneurship. By leveraging this technology, social entrepreneurs can enhance their impact and contribute to sustainable development in meaningful ways. The findings provide valuable insights for practitioners, policymakers, and educators, offering a roadmap for integrating AR into social business models effectively.

The effectiveness of AR in enhancing engagement and learning outcomes can be attributed to its immersive and interactive nature. AR creates engaging experiences that facilitate deeper understanding and retention of information. The ability to visualize complex concepts in an interactive environment enhances the learning process and makes it more enjoyable. This is particularly important in education and healthcare, where understanding and retention are critical for success.

The positive impact of AR in healthcare can be explained by its ability to provide timely and accessible services. AR-enabled applications allow for remote monitoring, real-time communication, and personalized care, which are crucial for managing chronic conditions and improving patient outcomes. The convenience and accessibility of AR make it particularly valuable in healthcare settings.

The correlation between sustained AR use and success highlights the importance of continuous adaptation and improvement. Long-term use allows social entrepreneurs to refine their technological solutions based on feedback and evolving needs. This iterative process leads to more effective and sustainable outcomes. The significant role of community engagement in amplifying the effectiveness of AR applications underscores the importance of user involvement in the design and implementation processes.

The diverse applications of AR across different sectors demonstrate its versatility and potential for wide-ranging impact. AR's ability to create immersive and interactive

experiences makes it an effective tool for addressing complex social and environmental challenges. These findings provide valuable insights for practitioners, policymakers, and educators, offering a roadmap for integrating AR into social business models effectively.

Future research should focus on longitudinal studies to assess the long-term impact of AR in social entrepreneurship. Understanding the sustained effects of AR will provide deeper insights into its potential for driving lasting social change. These studies can also identify best practices for maintaining and enhancing the impact of AR applications over time. Researchers should explore innovative uses of AR beyond the current applications, experimenting with new tools and approaches to address diverse community challenges.

Social entrepreneurs should be encouraged to integrate AR into their strategies and operations. Providing resources, training, and infrastructure can enhance their ability to leverage these tools effectively. Policymakers and funding bodies should consider supporting initiatives that promote the use of AR in social enterprises. By investing in AR applications, they can drive broader adoption of this technology and amplify its impact on community challenges.

Educational institutions and training programs should include curricula focused on the use of AR in social entrepreneurship. Equipping future social entrepreneurs with the knowledge and skills to utilize these tools can enhance their ability to create impactful solutions. This education can foster a new generation of innovators who are adept at using technology to address social and environmental challenges.

Technology developers should consider the specific needs and constraints of social enterprises when designing AR solutions. By creating AR tools that are accessible, affordable, and user-friendly, developers can ensure that these technologies can be effectively utilized by social entrepreneurs. Collaboration between social entrepreneurs and technology developers can lead to the creation of innovative solutions that drive sustainable development and social impact.

## CONCLUSIONS

The most important finding of this research is that augmented reality (AR) significantly enhances the effectiveness of social business models by improving user engagement, education, and operational efficiency. Social enterprises utilizing AR reported higher levels of community engagement and greater impact on their social and environmental goals. The study demonstrated that AR is particularly effective in the education and healthcare sectors, transforming traditional methods and improving outcomes. These findings underscore the potential of AR to drive sustainable development through innovative applications in social entrepreneurship.

The positive correlation between the duration of AR use and the success of social enterprises highlights the importance of sustained investment in AR technology. Additionally, high levels of community engagement were found to amplify the effectiveness of AR applications, emphasizing the role of user involvement in achieving successful outcomes. These insights provide valuable guidance for social entrepreneurs on how to leverage AR to maximize their impact.

This research contributes significantly to the field of social entrepreneurship by offering a detailed analysis of the specific applications and long-term impacts of AR technology. The mixed-methods approach, combining quantitative surveys and qualitative case studies, provides a comprehensive understanding of the factors that contribute to the successful integration of AR in social business models. This methodological framework can guide future research and development, helping social entrepreneurs to design more effective and scalable interventions.

The study also underscores the importance of tailored and context-sensitive approaches in leveraging AR technology. By providing practical examples and strategies, this research offers a valuable conceptual framework for integrating AR into social enterprises. This framework can help other social entrepreneurs replicate successful models and scale their impact, thereby contributing to sustainable development.

One limitation of this study is its relatively short-term focus, which does not allow for the assessment of the long-term impact of AR on social enterprises. Longitudinal studies are needed to evaluate the sustained effects of AR and to identify best practices for maintaining their impact over time. The sample size, while sufficient for this study, could be expanded in future research to include a more diverse and larger population.

Further research should also explore the scalability of these findings across different types of AR applications and social sectors. Investigating the effectiveness of various interactive media formats and their applications can provide broader insights into how technology can be leveraged for social good. Future studies could also examine the integration of real-world data and scenarios to enhance the relevance and impact of AR in social entrepreneurship.

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