



Economic Theory

Ramakrishnan VIVEK

**A COMPREHENSIVE REVIEW
OF ENVIRONMENTAL TRIANGULATION
IN QUALITATIVE RESEARCH:
METHODOLOGIES, APPLICATIONS,
AND IMPLICATIONS**

Abstract

Environmental triangulation, a cornerstone of qualitative research, emphasizes the systematic exploration of phenomena across diverse environmental contexts, enhancing the depth, breadth, and credibility of research findings. This comprehensive review delves into the nuances of environmental triangulation, examining its methodologies, applications, advantages, limitations, and implications. The study elucidates the method's foundational principles, contrasting it with other triangulation techniques like data, investigator, and methodological triangulation. While environmental triangulation offers a unique lens for capturing multifaceted insights, it also presents challenges in terms of logistics, cultural nuances, and data interpretation. The implications of this strategy are vast, influencing research design, data collection, analysis, and stakeholder engagement. With the integration of emerging technologies like AI and big data, environmental triangulation stands at the cusp of a transformative shift, offering promising prospects contrasted with ethical and methodological challenges. Contemporary trends indi-

© Ramakrishnan Vivek, 2023.

Vivek, Ramakrishnan, MBA, MSC in Business & Psychology, research student at the Catholic University of Eichstaett-Ingolstadt, Germany; assistant lecturer at the Sri Lanka Technological Campus, Padukka, Sri Lanka. ORCID: 0000-0001-5691-6825 Email: arvivek46@gmail.com

cate an expansion of the method to encompass digital landscapes, interdisciplinary collaborations, and global challenges. This review serves as a comprehensive guide for scholars, illuminating the intricacies of environmental triangulation and charting its evolving trajectory in the qualitative research landscape.

Key Words:

environmental triangulation; qualitative research methodologies; interdisciplinary collaboration; digital environmental contexts.

JEL: J21, J44, C80, O15, O38.

18 references.

Problem Statement

Triangulation, as a multifaceted research strategy, has long been revered for its role in enhancing the reliability and validity of research findings in both quantitative and qualitative studies. The concept's origins come from navigational and surveying techniques where it was used to determine locations by measuring angles from fixed points. In research, it refers to the use of multiple methods, data sources, researchers, or theories to cross-check and corroborate findings. One of its less explored, yet highly impactful branches is environmental triangulation, which forms the focal point of this comprehensive review. Environmental triangulation, involves the meticulous collection of data from diverse environments or contexts. It provides a robust approach to understanding phenomena by incorporating a multitude of perspectives and sources of information. This approach is grounded in the belief that observing a phenomenon in varying environments enhances the depth and breadth of understanding, thus offering a richer, more nuanced picture of the studied subject. By examining a concept across different settings, researchers can distil the invariant components of the phenomenon, mitigating the biases and limitations inherent in studying it within a singular environment (Bans-Akutey & Tiimub, 2021).

The importance of environmental triangulation is underscored by its ability to enhance the credibility and dependability of research outcomes. In qualitative research, the quest for truth is often complex and multifaceted, with researchers grappling with the inherent subjectivities and complexities of human experience and perception. Environmental triangulation serves as a beacon in this intricate landscape, allowing researchers to navigate through the myriad of subjective realities and draw closer to a more objective understanding of the phenomena under study (Abdalla et al., 2018).

This review aims to provide a detailed examination of environmental triangulation, delving deep into its methodologies, applications, and implications in qualitative research. It seeks to illuminate the conceptual underpinnings of environmental triangulation, compare it with other forms of triangulation, and explore its advantages and limitations. By exploring specific applications and case studies, this review will demonstrate how environmental triangulation has been instrumental in enriching qualitative research findings across various disciplines and research paradigms.

Environmental triangulation is particularly crucial in a world marked by unprecedented diversity and constant flux. The myriad of socio-cultural, economic, and geographical contexts present unique settings where phenomena manifest differently. By leveraging environmental triangulation, researchers can dissect the intricate tapestry of variables and conditions prevalent in different environments, thus attaining a more holistic and nuanced understanding of their subject matter. This approach ensures that research findings are not merely context-specific snapshots but are reflective of a broader, more inclusive reality. However, employing environmental triangulation is not without its challenges. The diversity of environments often brings forth a plethora of variables, some of which may confound the findings. Additionally, the logistical and ethical considerations in collecting data across different environments necessitate careful planning and execution. These challenges, while daunting, are not insurmountable and can be addressed through meticulous research design and execution (Fusch et al., 2018).

The implications of environmental triangulation are far-reaching, impacting not only the research community but also a myriad of stakeholders including policymakers, practitioners, and the general populace. This method offers a pathway to more credible, reliable, and generalizable findings, thereby influencing decision-making, policy formulation, and practice across various sectors. Moreover, it raises pertinent ethical considerations, especially when deployed across diverse socio-cultural and economic landscapes, necessitating a re-evaluation and strengthening of ethical research practices.

Environmental triangulation stands as a pivotal qualitative research strategy, offering a multidimensional lens through which phenomena can be studied and understood. This review aspires to contribute to the growing body of knowledge on environmental triangulation, fostering a deeper understanding and appreciation of its role, value, and implications in qualitative research. Through a

meticulous exploration of its methodologies, applications, and ramifications, this review hopes to inspire and guide researchers in leveraging environmental triangulation to enrich their research endeavours and contribute to the advancement of knowledge in their respective fields.

This comprehensive review is structured to offer readers an in-depth exploration of environmental triangulation, starting from its conceptual foundations, methodologies, and applications to its implications and challenges. The ensuing sections will delve into the various aspects of environmental triangulation, drawing from a diverse range of studies and examples, providing a rich, balanced, and nuanced perspective on this pivotal research strategy.

This text is a conceptual exploration, aimed at scholars, researchers, and academics engaged in qualitative research. This comprehensive review is meant to serve as a valuable resource, providing insights and guidance to those keen on employing environmental triangulation in their research endeavours, thereby pushing the boundaries of knowledge and understanding across diverse fields and disciplines.

Methodology of Environmental Triangulation

Environmental triangulation at its core is an intricate blend of qualitative research methodologies designed to enhance the depth, breadth, and reliability of research outcomes. Conceptually grounded in the broader realm of triangulation, it uniquely focuses on the systematic collection of data from varying environmental contexts. This methodology emphasizes the belief that the environment, with its unique set of socio-cultural, economic, and physical attributes, plays a pivotal role in shaping the manifestation and interpretation of a phenomenon (Abdalla et al., 2018).

From a definitional standpoint, *environmental triangulation* can be described as a research strategy that mandates the collection of data from diverse environments or contexts to bolster the credibility and reliability of qualitative findings. By doing so, it endeavours to mitigate potential biases and limitations that may emerge when a phenomenon is studied within a singular or limited environment. The underlying rationale is that environments, in their myriad forms, harbour specific characteristics that can influence, alter, or shape the nature and interpretation of the phenomenon under study. By integrating data from multiple environments, researchers can ascertain the invariant components of the phenomenon, thus drawing closer to a more objective, holistic understanding (da Silva Santos et al., 2020).

The main principles that underpin environmental triangulation have been described by Kaman & Othman (2016). First, **Multifaceted Exploration** as a

principle emphasizes the need to study a phenomenon across different environmental settings to capture its diverse manifestations. Second, **Mitigation of Bias** means that by diversifying the environments from which data is collected, researchers can reduce the likelihood of environment-specific biases influencing the outcomes. Third, **Enhanced Credibility** refers to the fact that gathering data from varied environments enhances the trustworthiness of findings, as it underscores the consistency and reliability of observed patterns across different contexts. Finally, **Contextual Richness** of environmental triangulation allows for a richer, more nuanced understanding of a phenomenon by highlighting how varying environmental factors may influence its emergence or interpretation.

Environmental triangulation serves as a compass for qualitative researchers, directing them towards a more holistic, comprehensive understanding of their subject matter. By recognizing the pivotal role environments play in shaping research outcomes, this methodology underscores the need for a multifaceted, context-rich exploration of qualitative phenomena.

Research Results

Comparison with Other Triangulation Methods

Triangulation, as a broader research strategy, has always been instrumental in bolstering the robustness and credibility of research findings. The essence of triangulation lies in its ability to capture a multifaceted view of a phenomenon, thus reducing biases and enhancing the depth of understanding. Within this realm, environmental triangulation emerges as a distinct yet complementary strategy. To discern its unique position, it is imperative to juxtapose environmental triangulation against its counterparts: data, investigator, and methodological triangulations (Guion et al., 2011).

Data Triangulation involves gathering information through various sources at different times, places, or from different individuals. The emphasis here is on the diversification of data sources to achieve a holistic understanding. While both data and environmental triangulation underscore the importance of diverse sources, the latter specifically prioritizes varying environmental contexts. Thus, while data triangulation might gather diverse accounts on a subject from different individuals within a singular environment, environmental triangulation seeks diverse accounts by deliberately changing the environmental context, ensuring the findings are not mere artifacts of a specific setting (Bans-Akutey & Tiimub, 2021).

Investigator Triangulation involves multiple researchers or evaluators analysing the same dataset, ensuring that the findings aren't influenced by indi-

vidual biases. While investigator triangulation focuses on the diversification of human agents in the research process, environmental triangulation emphasizes the diversification of contexts or settings. Both approaches, though distinct, can be complementary. Engaging multiple investigators to study a phenomenon across different environments can offer a rich tapestry of insights, blending the strengths of both strategies (Guion et al., 2011).

Methodological Triangulation encompasses the use of multiple methods to study a particular phenomenon. This could involve mixing qualitative and quantitative approaches or using different qualitative methods for a single study. Environmental triangulation, in contrast, remains rooted in qualitative research but diversifies the environmental contexts of data collection. Nevertheless, combining methodological and environmental triangulation can be particularly potent. For instance, employing different research methods across diverse environments can provide a nuanced, multifaceted understanding of a subject, ensuring both methodological rigor and contextual richness (Bans-Akutey & Tiimub, 2021).

However, while each triangulation strategy has its unique strengths and focal points, environmental triangulation stands out for its emphasis on the role of environment in shaping and influencing research outcomes. However, it is not in competition with other triangulation methods – instead it complements them. A holistic research approach might very well integrate environmental triangulation with data, investigator, and methodological triangulation, combining them together to produce a rich, comprehensive, and credible collection of insights. Such an integrative approach not only harnesses the strengths of each method but also mitigates their individual limitations, pushing the boundaries of qualitative research to new horizons.

Applications in Qualitative Research

Field Studies

Environmental triangulation can be a valuable tool for field studies as it allows researchers to collect data from different perspectives and in different contexts. This can help to reduce bias and increase the validity of the findings. Next are a few examples of how environmental triangulation has been used in field studies.

First, a study of homelessness in Los Angeles used environmental triangulation to collect data from people experiencing homelessness at different times of day in different neighbourhoods and in different weather conditions (Gelberg et al., 1997). This helped the researchers to understand the full range of experiences of homelessness and to identify the factors that contribute to it.

Furthermore, in a study of youth culture in a rural community environmental triangulation was used to collect data from young people in different social settings such as schools' community centres and hangouts (Skelton & Valentine, 1998). This helped the researchers to understand the different ways that young people express their identity and culture.

Finally, a study conducted on the effects of climate change on indigenous communities in the Arctic used environmental triangulation to collect data from community members in different seasons and locations (Ford et al., 2006). This helped the researchers to understand how climate change is impacting indigenous communities in different ways and to identify the most effective adaptation strategies.

Case Studies

Environmental triangulation can also be used to enrich the findings of case studies. By collecting data from different perspectives and in different contexts, researchers can gain a more comprehensive understanding of the case. Examples of case studies that have leveraged environmental triangulation to enrich their findings include a case study of a school shooting, where it was used to collect data from students, teachers, administrators, and parents (O'Toole, 2009). This helped the researchers to understand the factors that contributed to the shooting, as well as the impact of the shooting on the school community. Another case study on corporate fraud scandals used environmental triangulation to collect data from employees at different levels of the company, as well as from regulators and other stakeholders (Sutherland et al., 1983). This helped the researchers to understand how the fraud was perpetrated and to identify the factors that contributed to it. Furthermore, a case study of a natural disaster used environmental triangulation to collect data from people who were affected by the disaster, as well as from first responders and government officials. This helped the researchers to understand the impact of the disaster on the community and to identify the most effective response strategies (Alexander, 2002).

Multisite Research

Environmental triangulation is particularly useful for multisite qualitative studies, as it allows researchers to collect data from different sites and to compare and contrast the findings. This can help to identify patterns and trends that would not be evident from a single-site study. Two examples demonstrate how multisite qualitative studies have utilized environmental triangulation to increase the validity of their results. One multisite study of the effects of school uniforms on student behaviour used environmental triangulation to collect data from schools in different urban, suburban, and rural areas. This helped the researchers to understand how school uniforms impact student behaviour in different contexts (Dee, 2004). Another multisite study on the experiences of refugees in different countries used environmental triangulation to collect data from refugees in different stages of the resettlement process. This helped the researchers to understand the challenges and opportunities that refugees face at different stages of their resettlement (Vivek et al., 2023).

Implications of Environmental Triangulation

For Researchers

The utilisation of environmental triangulation as a research strategy carries significant implications for researchers, particularly in the domains of research design, data collection, and analysis. The utilisation of this particular strategy, which places a strong emphasis on the diversification of environmental contexts, not only serves to shape the course of research but also introduces subtle nuances that have the potential to greatly influence the final outcomes (Vivek & Nanthagopan, 2021).

The realm of research design stands at the forefront of these implications. The successful incorporation of environmental triangulation into research methodologies requires the development of a comprehensive design framework that effectively facilitates the systematic examination of various environmental contexts. In the pursuit of scientific inquiry, researchers are driven to transcend the confines of traditional singular-setting studies. This necessitates a broader approach that encompasses a diverse range of environments. The endeavour of expansion, although promising a more intricate and comprehensive array of insights, necessitates a rigorous and thorough approach to planning. The design should incorporate measures to address potential confounding variables that may arise from varying environments, thereby ensuring that the central phenomenon being investigated remains the primary focus, unaffected by irrelevant factors (Abdalla et al., 2018).

The process of data collection, a critical phase in research, is significantly impacted by the concept of environmental triangulation. The acquisition of data from diverse environments presents a complex logistical challenge, necessitating researchers to possess a high level of proficiency in navigating a wide range of socio-cultural, economic, and physical terrains. The aforementioned circumstances not only present practical obstacles, such as language barriers or geographical limitations, but also necessitate a heightened awareness of cultural subtleties and ethical deliberations. The researchers are entrusted with the crucial duty of guaranteeing that their methods for collecting data are culturally sensitive, ethically sound, and contextually relevant. This necessitates finding a harmonious equilibrium between maintaining methodological rigour and adapting to the specific context in which the research is conducted (Abdalla et al., 2018).

Furthermore, the field of data analysis is currently experiencing a significant paradigm shift as it embraces the integration of environmental triangulation. The process of analysing data from diverse environments presents a multitude of challenges, as researchers are tasked with identifying patterns that remain consistent across a range of settings. The complexity of this matter necessitates a nuanced

methodology, wherein researchers must not only discern overarching patterns but also possess a comprehensive understanding of and adaptability to environment-specific variations. The process of analysis entails a complex interplay of identifying fundamental principles and acknowledging the diverse nuances that arise within specific contexts. Meticulous examination guarantees that the results obtained possess a dual quality of being applicable to a broader context while also being firmly grounded in the unique characteristics of each individual setting (Ashour, 2018).

The concept of environmental triangulation presents a promising avenue for researchers to achieve more robust and trustworthy research findings. However, it also brings forth a set of intricate challenges that researchers must skilfully navigate in order to ensure the integrity and validity of their studies. Researchers consistently face the demanding task of finding a harmonious equilibrium between methodological rigour and contextual sensitivity. This delicate balance encompasses various aspects, ranging from the complexities involved in designing multi-environment studies to the obstacles encountered during the collection and analysis of data across diverse settings.

For Stakeholders

The adoption of environmental triangulation in research reaches beyond the academic sphere, holding significant implications for a broader audience, notably stakeholders such as policymakers, organizations, and the general public. The nuanced insights derived from studies that employ this methodology have the potential to shape decisions, strategies, and perceptions across various sectors.

For policymakers, the findings derived from environmental triangulation offer a more comprehensive and holistic understanding of a phenomenon. Since these findings are anchored in diverse environmental contexts, they present a broader picture, unmarred by the biases of a singular setting. This depth and breadth of understanding are instrumental in crafting policies that are both effective and inclusive. Policies grounded in such comprehensive research are more likely to resonate with a wider audience, addressing the needs and concerns of diverse groups. The enhanced credibility of these findings, stemming from their multi-environmental roots, ensures that policies are not only robust but also enjoy greater trust and acceptance among the populace (Abdalla et al., 2018).

Organizations, whether they operate in the private or public sector, stand to benefit immensely from the enriched insights provided by environmental triangulation. In a globalized world where organizations often span diverse geographical and cultural landscapes, understanding phenomena across different environments becomes pivotal. Whether it's market research for a multinational corporation or impact assessment for a global non-profit, the findings from environmental triangulation offer a nuanced perspective that can shape strategies, interventions, and initiatives. The enhanced credibility of these findings ensures that organiza-

tional decisions are both evidence-based and contextually relevant, leading to more effective and impactful outcomes (Ashour, 2018).

The general public, often the end beneficiaries or subjects of research, also stand to gain from the employment of environmental triangulation. Research that captures the multifaceted nature of a phenomenon, by virtue of its diverse environmental exploration, is more likely to resonate with a broader audience. The general public can trust the credibility of such findings, knowing that they are not mere snapshots of a specific context but reflective of a wider reality. This trust is paramount, especially when such research informs public discourse, social interventions, or community initiatives (Abdalla et al., 2018).

Ethical Considerations

Environmental triangulation, with its emphasis on exploring diverse environmental contexts, inherently delves into the intricate tapestry of varying cultural and socio-economic settings. While this approach undeniably offers richer, more nuanced insights, it also brings forth a plethora of ethical considerations that researchers must conscientiously navigate. The act of transcending singular settings and venturing into multiple environments amplifies the ethical responsibilities of the researcher, introducing complexities that are both profound and multifaceted (Bans-Akutey & Tiimub, 2021).

At the heart of these ethical considerations lies the challenge of cultural sensitivity. Each environment, with its unique cultural landscape, holds specific values, beliefs, and norms. When researchers employ environmental triangulation, they are tasked with the responsibility of understanding and respecting these cultural nuances. It becomes imperative to ensure that research methods, interventions, and interactions are aligned with the cultural ethos of the environment in question. Missteps, whether inadvertent or otherwise, can lead to misinterpretations, misrepresentations, or even harm to the participants, undermining the very credibility and integrity of the research (da Silva Santos et al., 2020).

Equally pressing is the consideration of power dynamics, especially when environmental triangulation spans environments with varied socio-economic backgrounds. Environments marked by socio-economic vulnerabilities can introduce power imbalances between the researcher and the participants. Researchers must be acutely aware of these dynamics, ensuring that their presence does not inadvertently coerce, exploit, or marginalize the participants. Consent, in such settings, becomes a nuanced concept, demanding more than mere agreement but encompassing informed, voluntary, and continuous participation (Bans-Akutey & Tiimub, 2021).

Furthermore, the act of collecting data across diverse environments introduces challenges related to data privacy and confidentiality. Different environments might have varying norms and regulations pertaining to data collection, storage, and dissemination. Researchers must not only familiarize themselves

with these regulations but also ensure that their practices uphold the highest standards of data ethics. This involves guaranteeing that participant identities are protected, data is securely stored, and findings are disseminated in a manner that respects the rights and dignity of the participants.

Another pivotal ethical consideration pertains to the representation of findings. The diverse insights derived from multiple environments can present a mosaic of perspectives. Researchers are entrusted with the responsibility of ensuring that these perspectives are presented authentically, without amplifying or muting specific voices. The portrayal of these findings must be balanced, devoid of biases, and reflective of the true essence of the environments in question.

Challenges and Future Directions: Barriers to Implementing Environmental Triangulation

The attraction of environmental triangulation, with its promise of enhanced depth and breadth of research findings, is tempered by a series of challenges that may hinder its widespread adoption. These barriers, both intrinsic to the methodology and extrinsic in the broader research landscape, can make the implementation of environmental triangulation a formidable endeavour for many researchers (Ndanu & Syombua, 2015).

One of the most palpable barriers lies in the logistical challenges associated with collecting data across diverse environments. The act of venturing beyond singular settings and delving into multiple environments demands significant resources. Researchers may grapple with constraints related to time, finances, and accessibility. Each additional environment introduced into the study amplifies the logistical complexity, making the research process more cumbersome and resource-intensive. The logistical challenges are exacerbated by the intricate maze of cultural and socio-economic dynamics that researchers must navigate. Each environment, with its unique set of cultural norms, values, and practices, demands a nuanced understanding. Researchers must invest time and effort in familiarizing themselves with these nuances to ensure that their research methods and interactions are culturally sensitive and ethically sound. The risk of misinterpretation or misrepresentation, stemming from cultural misalignment, can deter many from venturing into unfamiliar terrains (da Silva Santos et al., 2020).

Furthermore, the challenge of isolating the impact of environmental variables poses a significant barrier. With each environment introducing a plethora of factors, discerning which elements influence the observed patterns or insights becomes a complex task. Researchers may find themselves in the labyrinthine task of disen-

tangling the myriad influences, striving to ensure that their findings are reflective of the core phenomenon and not mere artifacts of environmental specificities.

Technological Innovations

The intricate relationship between environmental triangulation and the advancement of technologies, specifically artificial intelligence (AI) and big data, showcases a fascinating interplay between established qualitative research methods and state-of-the-art technological breakthroughs. The ongoing evolution of the digital age has brought about significant transformations in the field of research, particularly in terms of redefining established paradigms. In this context, the integration of digital technologies into the practice of environmental triangulation presents a multitude of promising prospects as well as captivating challenges (Ashour, 2018).

Artificial Intelligence (AI), with its diverse range of capabilities in areas such as pattern recognition, data analysis, and predictive modelling, has the potential to greatly enhance the process of environmental triangulation. The inherent difficulty associated with this particular methodology lies in the extensive and intricate nature of the data obtained from various environmental settings. Artificial intelligence (AI) has the potential to optimise the data processing workflow by efficiently detecting patterns, anomalies, and correlations that may be difficult to identify through manual analysis. Natural language processing (NLP), a prominent branch of artificial intelligence (AI), plays a pivotal role in the analysis of textual data across diverse domains. Its ability to discern linguistic nuances and contextual subtleties with exceptional precision makes it an invaluable tool in this regard. The utilisation of automated processes not only expedites the analytical procedure but also guarantees a level of thoroughness and precision that is frequently difficult to attain through manual means (Ashour, 2018).

The integration of big data into environmental triangulation is a valuable asset, as it offers an extensive repository of information derived from a wide range of sources. The examination of environmental contexts, when observed from the perspective of big data, undergoes a profound metamorphosis into complex digital ecosystems, brimming with a multitude of valuable insights derived from various sources such as social media feeds, digital transactions, online interactions, and data generated by sensors. The incorporation of this extensive dataset into the process of environmental triangulation has the potential to yield a more comprehensive understanding of the phenomenon being investigated. The utilisation of digital footprints in conjunction with traditional qualitative data enables researchers to create a comprehensive perspective that encompasses both the tangible and intangible aspects of a given environment (Shao et al., 2022).

The incorporation of artificial intelligence (AI) and big data into the realm of environmental triangulation presents a set of inherent challenges. The prominence of ethical considerations becomes evident, particularly in relation to the areas of data privacy and consent. The proliferation of extensive digital footprints

left by individuals has proven to be an invaluable resource for research purposes. However, it has also given rise to legitimate concerns surrounding issues of anonymity, consent, and the potential for data misuse. In the pursuit of technological advancements, researchers are confronted with a complex ethical landscape that demands meticulous navigation. It is imperative for them to exercise utmost diligence in order to guarantee that the integration of technology upholds the fundamental rights and preserves the inherent dignity of all participants involved (Shao et al., 2022).

Moreover, the proliferation and intricate nature of data generated through the utilisation of artificial intelligence and big data necessitate the establishment of resilient methodological frameworks. The integration of digital data has necessitated the need for traditional qualitative approaches to undergo adaptation or evolution. The recalibration of analytical strategies, representation methods, and validation protocols is crucial in order to maintain the credibility, validity, and trustworthiness of the findings obtained through this integration.

Emerging Trends in Environmental Triangulation

Environmental triangulation, as a qualitative research strategy, has historically been centred on the exploration of diverse physical and socio-cultural environments. However, as the research landscape evolves, marked by technological advancements and shifting paradigms, new trends and shifts are emerging in the realm of environmental triangulation.

One of the most prominent trends is the incorporation of virtual and digital environments into the triangulation process. With the proliferation of digital platforms, online communities, and virtual realities, researchers are beginning to recognize these spaces as distinct environments, replete with their own set of dynamics, norms, and interactions. Environmental triangulation is expanding its horizons to include these digital landscapes, offering insights that blend the tangible with the intangible, the physical with the virtual (Bans-Akutey & Tiimub, 2021).

Furthermore, there's a growing emphasis on interdisciplinary collaboration in environmental triangulation. Recognizing that environments are multifaceted entities influenced by a myriad of factors, researchers are increasingly collaborating across disciplines. For instance, a study exploring a phenomenon across urban and rural settings might incorporate insights from urban planners, sociologists, and environmental scientists, ensuring a holistic understanding (Bans-Akutey & Tiimub, 2021).

Additionally, as global challenges like climate change, migration, and pandemics reshape the world, there's a growing trend to employ environmental triangulation in studies that address these issues. By exploring these challenges across diverse environmental settings, researchers can derive insights that are both context-specific and universally relevant.

Conclusions

The thorough review of environmental triangulation in qualitative research shows how important environmental triangulation is as a research method and how its uses have been changing over time. In the past, environmental triangulation was seen as an important part of qualitative research. It improves the depth, range, and reliability of research results by looking at things in a planned way in a number of different environmental settings. This review talks about how this method gives a unique perspective that can give multiple insights that are both situation-specific and generally useful.

As virtual and digital worlds become more integrated, new trends point to a huge change in environmental connectivity. As digital platforms, online communities, and virtual worlds become more popular, experts are starting to see them as separate places with their own rules, interactions, and dynamics. This broadening of the scope of methodology offers insights that combine the real and the imagined, the physical and the virtual, in a way that is fluid.

The review also stresses how important it is for people from different fields to work together in environmental triangulation. Because environments are complex and affected by many things, we need to work together across fields to get a full picture of them. Using environmental triangulation to study modern-world problems like climate change and pandemics is even more important because it helps researchers find patterns that apply to a wide range of environmental settings.

Given how environmental triangulation is changing in qualitative research, it is important for scholars to accept the use of digital landscapes in their methods and fully grasp how they work and what they can reveal. Prioritising teamwork between people from different fields will lead to a more comprehensive method that uses the knowledge of many areas. Institutions and other interested parties should put money into tools that help with both old-fashioned and modern triangulation methods, but they should keep an ethical eye on things at all times, especially in digital and virtual worlds. Given that today's problems affect people all over the world, using environmental triangulation should provide both specific localised details and wider, more general insights. This will make sure that research stays useful and has an effect.

References

- Abdalla, M., Oliveira, L., Azevedo, C., & Gonzalez, R. (2018). Quality in Qualitative Organizational Research: Types of triangulation as a methodological alternative. *Administração: Ensino e Pesquisa*, 19, 66–98. <https://doi.org/10.13058/raep.2018.v19n1.578>
- Alexander, D. (2002). The Study of natural disasters, 1977–97: Some reflections on a changing field of knowledge. *Disasters*, 21, 284–304. <https://doi.org/10.1111/1467-7717.00064>
- Ashour, M. (2018). Triangulation as a powerful methodological research technique in technology-based services. *Business & Management Studies: An International Journal*, 6(1), 193–208. <https://doi.org/10.15295/v6i1.209>
- Bans-Akutey, A., & Tiimub, B. M. (2021). Triangulation in research. *Academia Letters*, Article 3392. <https://doi.org/10.20935/AL3392>
- da Silva Santos, K., Ribeiro, M. C., de Queiroga, D. E. U., da Silva, I. A. P., & Ferreira, S. M. S. (2020). The use of multiple triangulations as a validation strategy in a qualitative study [in Portuguese]. *Ciencia & Saude Coletiva*, 25(2), 655–664. <https://doi.org/10.1590/1413-81232020252.12302018>
- Dee, T. (2004). Teachers, Race, and student achievement in a randomized experiment. *The Review of Economics and Statistics*, 86, 195–210. <https://doi.org/10.1162/003465304323023750>
- Ford, J., Smit, B., & Wandel, J. (2006). Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Global Environmental Change*, 16, 145–160. <https://doi.org/10.1016/j.gloenvcha.2005.11.007>
- Fusch, P., Fusch, G., & Ness, L. (2018). Denzin's Paradigm shift: Revisiting triangulation in qualitative research. *Journal of Social Change*, 10(1), 19-32. <https://doi.org/10.5590/JOSC.2018.10.1.02>
- Gelberg, L., Gallagher, T. C., Andersen, R. M., & Koegel, P. (1997). Competing priorities as a barrier to medical care among homeless adults in Los Angeles. *American Journal of Public Health*, 85(2), 217–220. <https://doi.org/10.2105%2Fajph.87.2.217>
- Guion, L., Diehl, D., & McDonald, D. (2011). Triangulation: Establishing the validity of qualitative studies. *EDIS*, 3. https://www.researchgate.net/publication/347809071_Triangulation_Establishing_the_Validity_of_Qualitative_Studies
- Kaman, Z., & Othman, Z. (2016, Apr). Validity, reliability and triangulation in case study method: An experience. In *Qualitative Research Conference (QRC)*

(Vol. 2016, pp. 24-26). <https://qualitative-research-conference.com/download/proceedings-2016/88-zettiey%20350-356.pdf>

- Ndanu, M.C., & Syombua, M. J. (2015). Mixed methods research: The hidden cracks of the triangulation. *General Education Journal*, 4(2),46-67. https://www.academia.edu/18131660/Mixed_Methods_Research_The_Hidden_Cracks_of_the_Triangulation_Design
- O'Toole, M. E. (2009). *The school shooter: A threat assessment perspective*. DIANE Publishing. <https://books.google.lk/books?id=1V1A6KEairIC>
- Shao, L., Yang, S., Fu, T., Lin, Y., Geng, H., Ai, D., Fan, J., Song, H., Zhang, T., & Yang, J. (2022). Augmented reality calibration using feature triangulation iteration-based registration for surgical navigation. *Computers in Biology and Medicine*, 148, 105826. <https://doi.org/10.1016/j.compbiomed.2022.105826>
- Skelton, T., & Valentine, G. (1998). *Cool places: Geographies of youth cultures*. Routledge. <https://books.google.sc/books?id=2CFn4uozYc4C>
- Sutherland, E. H., Geis, G., & Goff, C. (1983). *White collar crime: The uncut version*. Yale University Press. <https://books.google.lk/books?id=OMPvdcXGfecC>
- Vivek, R., & Nanthagopan, Y. (2021). Review and comparison of multi-method and mixed method application in research studies. *European Journal of Management Issues*, 29(4), 200–208. <https://doi.org/10.15421/192119>
- Vivek, R., Nanthagopan, Y., & Piriyaatharshan, S. (2023). Beyond methods: Theoretical underpinnings of triangulation in qualitative and multi-method studies. *SEEU Review*, 18(2), 105–122. <https://doi.org/10.2478/seeur-2023-0088>

Received: October 16, 2023.
Reviewed: October 23, 2023.
Accepted: December 18, 2023.