CSR in the Agri-Metaverse: Virtual Engagement, Sustainability Reporting, and Firm

La RSE en el metaverso agrícola: compromiso virtual, informes de sostenibilidad y empresa

Samuel Ejiro Uwhejevwe-Togbolo[1] ✉, **Nyerhovwon Okuku**[2], **Adaighofua Obue**[2], **Nelson Iguemedere Ofomaja**[3,4], **Ogheneovo Atie**[3,4]

[1]Department of Accounting, Dennis Osadebay University, Asabam Delta State-Nigeria.
[2]Deptart of Agricultural Science, College of Education, Warri, Delta State-Nigeria.
[3]Department of Mechenical Engineering, Maritime Polytechnique, Busurutu, Delta State-Nigeria.
[4]Department of Industrial Safety & Environmental Science, Maritime Polytechnique, Busurutu, Delta State-Nigeria.

Cite as: Uwhejevwe-Togbolo SE, Okuku N, Obue A, Iguemedere Ofomaja N, Atie O. CSR in the Agri-Metaverse: Virtual Engagement, Sustainability Reporting, and Firm. Diginomics. 2025;4:276. https://doi.org/10.56294/digi2025276

Corresponding author: Samuel Ejiro Uwhejevwe-Togbolo ✉

ABSTRACT

Metaverse integration in the agribusiness CSR practices constitutes a radical change of practice in companies to involve stakeholders, report sustainability, and performance motivation. Using virtual reality (VR), augmented reality (AR), blockchain, and artificial intelligence (AI) as the examples of the immersiveness technologies can open up new chances of transparent disclosure of CSR, consumer involvement, and accountability throughout the agricultural supply chains. Virtual simulations allow firms to showcase green farming methods, trace their supply chain, and participate in sustainability promotions with the help of consumers. Moreover, virtual engagement can be taken into consideration so that firms can report CSR activities credibly and minimise risks of virtual greenwashing. The quantitative research design was used in the study. There were 350 questionnaires that were distributed among managers and financial, accounting, sustainability, and operations professionals in 30 agribusiness firms. When all the incomplete responses were eliminated, 287 valid questionnaires remained, which constituted an effective response rate of 82 percent. The finding of regression analysis proved that CSR-AM is a significant predictor of firm performance. The study concluded that agri-metaverse allows companies to run CSR practices beyond conventional ones to create interactive and verifiable experiences. It was recommended that CSR in the agri-metaverse should be the incubator of innovation, farmer empowerment, and soaring ambitions in the agricultural industry, rather than branding efforts.

Keywords: CSR; Agri-Metaverse; Sustainability Reporting; Firm Performance; Virtual Engagement.

RESUMEN

La integración del metaverso en las prácticas de RSE de la agroindustria constituye un cambio radical en las prácticas de las empresas para involucrar a las partes interesadas, informar sobre la sostenibilidad y motivar el rendimiento. El uso de la realidad virtual (RV), la realidad aumentada (RA), la cadena de bloques y la inteligencia artificial (IA) como ejemplos de tecnologías inmersivas puede abrir nuevas oportunidades para la divulgación transparente de la RSE, la participación de los consumidores y la rendición de cuentas a lo largo de las cadenas de suministro agrícolas. Las simulaciones virtuales permiten a las empresas mostrar métodos de agricultura ecológica, rastrear su cadena de suministro y participar en promociones de sostenibilidad con la ayuda de los consumidores. Además, se puede tener en cuenta la participación virtual para que las empresas puedan informar de forma creíble sobre sus actividades de RSE y minimizar los riesgos de «greenwashing» virtual. En el estudio se utilizó un diseño de investigación cuantitativo. Se distribuyeron 350 cuestionarios entre directivos y profesionales de las finanzas, la contabilidad, la sostenibilidad y las operaciones de 30 empresas agroindustriales. Una vez eliminadas todas las respuestas incompletas, quedaron 287 cuestionarios válidos, lo que supuso una tasa de respuesta efectiva del 82 %. Los resultados del análisis de regresión demostraron que la RSE-AM es un predictor significativo del rendimiento de las empresas. El estudio concluyó que el metaverso agrícola permite a las empresas llevar a cabo prácticas de RSE más allá de las convencionales para crear experiencias interactivas y verificables. Se recomendó que la RSE en el metaverso agrícola fuera la incubadora de la innovación, el empoderamiento de los agricultores y las ambiciones crecientes en la industria agrícola, en lugar de los esfuerzos de branding.

Palabras clave: RSE; Metaverso Agrícola; Informes de Sostenibilidad; Rendimiento Empresarial; Compromiso Virtual.

INTRODUCTION

An agriculture industry is one of the sectors that the metaverse is transforming through the development of collaborative, training, and resource management platforms. [1] Other than productivity, it also provides agribusinesses with an alternative platform to execute and report corporate social responsibility (CSR). The traditional definition of CSR has been the consideration of environmental, social and ethical issues in the main business processes. [2,3] The common CSR activities in agribusiness include sustainable agriculture and farming, ethical sourcing and community participation. Nonetheless, the agri-metaverse allows expanding such practices into the virtual realm and by doing so, firms have an opportunity to present sustainability efforts in even greater detail and with greater transparency.

Blockchain, VR/AR, and AI integration into virtual farming ecosystems can facilitate symbolic reporting in the realm of CSR, which can also be verified. [4] As an example, blockchain can offer absolute traceability of farm-to-fork operations, whereas the simulations provided by VR/AR can enable firms to involve consumers in sustainable farming activities in real-time. [5] These efforts are in direct relation to the stakeholder theory which has suggested that it is important to take into consideration the needs of various groups, including farmers and consumers, as well as investors and regulators. [6]

This research will examine the impact of CSR in the agri-metaverse on the performance of firms, in terms of sustainability reporting and consideration of virtual interaction. In particular, it discusses the role of virtual engagement in enhancing accountability and establishing trust in agribusiness CSR to eventually generate social and financial value.

Literature Review

Agribusiness Corporate Social Responsibility.

The fact that the agribusiness sector is directly related to the environment, food security, and rural livelihoods has led to its inclusion of Corporate Social Responsibility (CSR). As compared to other industries, agriculture activities have a direct effect on the ecosystem, thus, making sustainable farming very important. The initiatives associated with CSR in agribusiness may be reduction of chemical inputs, implementation of environmentally friendly technologies, alleviation of the welfare of farmers, and food safety standards. [7] The practices are not merely compliance-based and this makes agribusinesses ethical players in the society. Moreover, CSR programs assist companies in standing out in the competitive markets whereby consumers are willing to consume food that is produced sustainably and ethically. [8] The studies have also revealed that active CSR practices in the agricultural sector create awakener brand equity and consumer loyalty, thus, establishing a connection between social accountability and financial performance. [9]

Emergence of the Metaverse in Agriculture

The idea of the metaverse has no longer been confined to the field of gaming and entertainment but applied in real-life scenarios in other sectors and agriculture is no exception. The metaverse is defined as a virtual world that is immersive and persistent, and takes advantage of artificial intelligence (AI), blockchain, and the extension of reality (XR) to reproduce virtual copies of real-world processes. [1] Metaverse technologies are also finding application in agriculture to develop digital twins of farms, enabling farms to be monitored and predictively analyzed in real-time in regard to their productivity. VR and AR devices are becoming more extensively used to train farmers and manage crops as well as to educate stakeholders. [10] Moreover, smart contracts with blockchain technology could support transparent transactions throughout agri-supply chains and minimize fraud and enhance accountability. As noted by [11], the same tools of immersion also enhance the relationships between consumers and firms as they provide opportunities to visit farms virtually, present the internal pursuit of sustainability in a credible and interesting way.

CSR in the Agri-Metaverse

Agri-metaverse CSR initiatives are the extension of the traditional agri-metaverse reporting practices to interactive and verifiable disclosures. Instead of releasing CSR information in fixed sustainability reports, companies can also follow the metaverse and communicate with stakeholders through virtual displays of sustainable practices like organic farming, soil restoration, and water conservation. The blockchain technology will make such claims transparent and traceable, minimizing the chances of greenwashing. [12] The agri-metaverse, therefore, transforms CSR into not a communication tool, but an experience of accountability, in which the stakeholder can observe practices in real time and confirm them. This is in line with the stakeholder theory, [6] which emphasizes the need to develop meaningful communication between the firm and the stakeholders. When applied to agriculture, the metaverse will allow interactions between producers, regulators, investors, and consumers to be more profound regarding sustainability issues.

CSR, Sustainability Reporting and Firm Performance

CSR and firm performance relationship is a well-documented relationship in the literature. CSR will play a role in the firm performance through improved reputation, minimization of operational risks, and innovation. [13] Empirical research has demonstrated that companies that are more effective in CSR attain more profitability, customer loyalty, and investor relation. [14] CSR in agribusiness is related to sustainability reporting, in which practices like carbon cuts, responsible sourcing, and fair labor are the main drivers of competitive edge through clear information communication. [15] [16] also highlight that the suppliers' partnership is usually closer in companies that have a sustainability orientation, which consequently leads to increased productivity and financial benefits. The agri-metaverse amplifies these dynamics by offering tools for metadata-driven reporting and AI-powered accountability, making sustainability practices more visible, interactive, and trustworthy. [17] Consequently, CSR in agri-metaverse does not only enhance the trust of stakeholders but also becomes a quantifiable force of the firm performance.

METHOD
Research Design

The research design chosen in this study was quantitative research design because it was aimed at testing the relationship between CSR in the agri-metaverse, sustainability reporting, and firm performance empirically. The choice of the approach was based on the fact that quantitative methods can be used to test cause-effect relationships and draw generalizable findings. [18] The researchers also included a moderating construct that explains the extent to which the CSR-performance relationship

depends on structured reporting practices, which is the virtual engagement.

Population and Sample

The study sample was comprised of professionals employed in agribusiness companies, agricultural cooperatives, food processing companies, and agri-tech startups. These organizations have been chosen due to their role in sustainability programs and growing use of digital platforms. There were 350 questionnaires that were distributed among managers and financial, accounting, sustainability, and operations professionals in 30 agribusiness firms. When all the incomplete responses were eliminated, 287 valid questionnaires remained, which constituted an effective response rate of 82 percent.

In terms of demography, 62 percent of the respondents were males and 38 percent females. On the question of age, 45 % of the respondents were in the bracket of 31-40, 34 percent were in 41-50 and 21 percent were above 50. With regard to work experience, 36 % reported less than 5 years, 40 % recorded between 6-10 and 24 % reported above 10 years of work experience. This heterogeneity gave an equalized set of data to test the proposed model.

Measures

The Agri-Metaverse of CSR (in other words, CSR in the Agri-Metaverse):

The scale that was used to measure CSR practices in virtual agricultural contexts was a modification of [8] CSR scale. Products were transformed into metaverse activities including: Our organization deals with virtual platforms to show off our sustainable farming practices, and Our organization uses the metaverse to engage stakeholders in environmental awareness. The responses were measured using the 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

The Sustainability Reporting (SR):

The scale was based on the adaptation of the [12] scale and used to measure sustainability reporting, i.e. a digital and metadata-based reporting. The items to be included in the sample were: Our organization verifies CSR claims using blockchain or AI-based tools, and our sustainability disclosures are transparent, verifiable, and accessible in virtual environments.

Firm Performance (FP):

The performance of the firm was measured using a scale that was adapted by [19] and [16]. There were both financial indicators (profitability, ROI, market share) and non-financial indicators (brand equity, consumer trust, innovation). One of the sample

items was: CSR initiatives in the metaverse have enabled our company to play a positive role in boosting its financial performance.

Accounting for Virtual Engagement (AVE):

The AVE was measured using some of the items that were designed in earlier research.[12,20] These evaluated the level at which companies implemented the use of structured accounting practices in CSR in virtual settings. The following were the sample questions: "Our company utilizes metadata to monitor the use of CSR in the metaverse, and AI-related analytics is used to gauge consumer involvement in virtual CSR campaigns.

Control Variables:

The research adjusted the gender, age, the size of the firm, and job experience since these factors have been identified to affect perceptions of CSR and performance outcomes.[21]

Data Analysis

The SPSS 26.0 and AMOS 24.0 were used to analyze the data. The analysis was done in three steps:

   i. Correlations and descriptive statistics to determine the relationship between variables.

   ii. Confirmatory Factor Analysis (CFA) in order to examine the validity and reliability of measurement scales.

   iii. The randomized regression test to evaluate the principal and combined CSR impact in the agri-metaverse, sustainability reporting, and accounting of virtual engagement on the performance of firms.

The test of reliability was based on Cronbachs alpha and values of greater than 0,70 were deemed satisfactory.[22] Average Variance Extracted (AVE) and Composite Reliability (CR) were used to measure convergent and discriminant validity.

RESULTS

For descriptive statistics and correlations, the researcher will apply factor analysis.

Table 1 shows means, standard deviations and correlation of all the variables of the study. The findings indicate that CSR in Agri-Metaverse (CSR-AM) has a positive correlation with both sustainability reporting (SR) ($r = 0,512$, $p < 0,01$) and the firm performance (FP) ($r = 0,468$, $p < 0,01$). On the same note, the virtual engagement (AVE) is positively associated with CSR-AM ($r = 0,554$, $p < 0,01$) and FP ($r = 0,493$, $p < 0,01$). These correlations give preliminary support on the formation of the hypothesized correlations.

Table 1. Descriptive Statistics and Correlation Matrix

Variables	Mean	SD	1	2	3	4
CSR in the Agri-Metaverse (CSR-AM)	4,16	0,65	1			
Sustainability Reporting (SR)	4,20	0,58	0,512**	1		
Firm Performance (FP)	4,22	0,61	0,468**	0,489**	1	
Accounting for Virtual Engagement (AVE)	4,18	0,59	0,554**	0,477**	0,493**	1

Note: $p < 0,01$.

Hypothesis Testing

H1: Agri-Metaverse CSR has a positive impact on the firm performance.

The finding of regression analysis proved that CSR-AM is a

significant predictor of firm performance ($r=0,274$, $p < 0,001$). This indicates that virtual CSR programs, including blockchain-based traceability, VR/AR simulations of sustainable farming, and immersive consumer engagement can improve the

agribusiness performance in terms of financial and reputational.

H2: Sustainability reporting is an intermediate variable between the CSR and firm performance relationship.

The findings show that sustainability reporting plays a significant role in mediation between the impact of CSR-AM and FP (indirect effect = 0,163-0,01). Companies that integrate CSR into online reporting systems (e.g. AI-enhanced disclosures, blockchain-validated records) experience greater returns to performance than their counterparts.

H3: The virtual engagement is a moderated relationship between CSR and firm performance.

The interaction term (CSR-AM x AVE) was also significant (r=0,196, p < 0,01) which implies that strong accounting practices enhance the positive effect of CSR in the metaverse on the performance of the firms. The change in R^2 and F change of 21,312 also support the moderating effect.

Table 2. Regression Analysis Results					
Variables	**β**	**t-value**	**p-value**	**R²**	**ΔR²**
Control Variables					
Gender	-0,021	-0,338	0,735		
Age	0,064	0,817	0,414		
Job Experience	0,049	0,622	0,534		
Firm Size	0,057	0,846	0,398		
Main Effects					
CSR-AM	0,274	4,692	0,000	0,329	0,317
Sustainability Reporting	0,312	5,241	0,000		
Moderation Effect					
CSR-AM × AVE	0,196	4,356	0,000	0,381	0,052

Summary of Results indicated that hypothesis (H1) was confirmed having CSR in agri-metaverse has a great impact on the performance of firms. Also, Hypothesis (H2) was confirmed that sustainability reporting is a mediating variable between the CSR and performance relationship, which increases accountability and credibility. While, hypothesis (H3) supported that virtual engagement accounted-based relationship enhances the CSR-performance relationship, where transparency of virtual reporting is more effective in enhancing stakeholder trust.

DISCUSSION

The key objective of the research was to identify the effects of CSR activities in the agri-metaverse on the performance of firms, in addition to the discussion of the responsibilities of sustainability reporting and accounting on virtual interaction. The results prove that CSR in immersive virtual space is not merely symbolic but also strategically beneficial, especially in the context of organized reporting systems.

To begin with, the findings were able to affirm that agri-metaverse CSR can contribute greatly to the firm performance. This is consistent with the existing research indicating the existence of a positive correlation between CSR and firm performance,[13,23] and introduces the literature to immersive technologies. Through traceability of supply chains based on blockchain, consumer education based on VR/AR, and gamified sustainability campaigns, agribusiness companies can create better reputations and create quantifiable competitive benefits. Indicatively, consumers who get a taste of sustainable farming are willing to believe the claims of CSR by the firm, which

increases customer loyalty and financial gains.[24]

Second, the sustainability reporting was found to mediate the CSRperformance relationship. This result confirms the idea that the accountability and stakeholder trusts can be improved through the transparent and verifiable CSR disclosures.[12] Reporting mechanisms are one of the factors that are critical to credibility in agribusiness where issues of food safety, environmental degradation, and labor rights are rampant. The agri-metaverse offers tools that are unlike others, e.g., metadata-based reporting and blockchain validation, and turn CSR into not a disclosure but an interactive and traceable activity.[1] The companies that incorporate such tools into their reporting systems have the advantage of increased investor trust and long-term performance.[16]

Third, it is important to note that the moderating role is played by the accounting due to virtual engagement, which highlights the significance of structured reporting systems. Companies that incorporate CSR data into AI analytics, metadata models, and registries based on blockchain achieve better performance results than those who do not. This is reminiscent of the request by [12] that the new accounting practices should be used to contend with sustainability in the digital world. Unless there are trustworthy accounting systems, CSR online will be perceived as an instance of virtual greenwashing. On the other hand, CSR turns into an actual source of firm value when accountability is created by use of digital records and verifiable engagement.

Theoretically, these results support the stakeholder theory,[6] according to which companies need to consider the interests of various groups of stakeholders. The agri-metaverse increases the participation of stakeholders in virtual environments, which makes CSR more inclusive, transparent, and participatory. Not only does this increase trust, long-term financial and reputational benefits of agribusiness firms are also created.

Practically, the findings can imply that agribusinesses must consider CSR in the metaverse as a strategic investment and not a marketing tool. The combination of immersive technologies with CSR would enable companies to be responsible to various stakeholders and at the same time become competitive in the international agriculture markets.

CONCLUSION

This study demonstrates the importance of corporate social responsibility (CSR), especially within agri-metaverse in the context of sustainability reporting, accounting and implications of firm performance. Findings confirm that immersive technology-based CSR activities can be applied as efficient governance tools to build trust and transparency as well as deliver financial and non-financial value in agribusiness. Agri-metaverse allows companies to run CSR practices beyond conventional ones to create interactive and verifiable experiences. Indicatively, traceability of agricultural supply chains (which is based on blockchain) is linked to credibility, whereas VR/AR simulation enables consumers/ other stakeholders to observe eco-friendly practices firsthand. Such developments help in brand equity, customer loyalty, and investor/institutional confidence, which are the cause of performance of firms.

Moreover, the study attracts attention to the relevance of sustainability reporting and taking into account the virtual engagement. Reporting systems that are transparent and verifiable turn the CSR initiatives into more than mere gestures and the right accounting systems help to prevent the risk of

the so-called virtual greenwashing. The two aspects are used to guarantee that CSR activities through agri-metaverse will contribute significantly to the competitiveness and sustainability of future firms.

Recommendations

The study made the following recommendations:

1. The conclusion made was that Agribusiness companies need to include virtual and augumented reality in their CSR frameworks. In order to allow agribusiness companies to capitalize on immersive technologies to engage, educate and be responsible.

2. Transition off of the old disclosures system to the digital-focused, blockchain-audited, and AI-enabled disclosure systems that enable transparency and comparability.

3. Accountants ought to collaborate with agribusiness enterprises to come up with structured mechanisms of measuring, classifying, and disclosing CSR practices in the metaverse.

4. The regulatory bodies should develop policies that will regulate CSR in online platforms to normalize it, avoid mal-utilization, and build trust among stakeholders.

5. CSR in the agri-metaverse should be the incubator of innovation, farmer empowerment, and soaring ambitions in the agricultural industry, rather than branding efforts.

The agri-metaverse is a paradigmatic platform of convergence of CSR, accounting, and sustainability. Using immersive technologies in a responsible manner, the agribusiness companies will be able to foster the improvement of performance, as well as make a contribution to the larger social and environmental objectives.

Limitations and Future Research Directions

The paper contributes significantly to the research on CSR in the agri-metaverse, although there are some weaknesses. To begin with, the professionals took part in the study in one national context, which might be limiting in generalization. Future research ought to take cross country comparisons and wider agribusiness into consideration. Second, there should be a risk of bias due to the use of self-reported information; the use of secondary sources can be considered an effective method to enhance validity, including blockchain records or digital engagement analytics. Third, the analysis was primarily aimed at explaining the effect of virtual engagement, whereas other variables, including organizational culture, digital literacy, and governmental framework, can also have an impact. Lastly, the possible mediation processes such as brand equity, stakeholder trust, or innovation were not addressed and need to be investigated in the future.

Generally, this study contributes to the knowledge on CSR in the agri-metaverse, but it also reveals the necessity to conduct additional research on the overall state of the organization and technologies in order to define its influence.

FUNDING

CONFLICT OF INTEREST
None.

AUTHOR CONTRIBUTION
Conceptualization: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Data curation: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Formal analysis: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Research: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Methodology: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Project management: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Resources: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Software: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Supervision: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Validation: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Visualization: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Writing – original draft: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

Writing – review and editing: Samuel Ejiro Uwhejevwe-Togbolo, Nyerhovwon Okuku, Adaighofua Obue, Nelson Iguemedere Ofomaja, Ogheneovo Atie.

REFERENCES

1. Chen F, Sun C, Xing B, Luo N, Liu H. Agricultural Metaverse: Key Technologies, Application Scenarios, Challenges and Prospects. J Smart Agric. 2022;4(4):126-37.

2. Coppola A, Ianuario S, Romano S, Viccaro M. Corporate social responsibility in agri food firms: the relationship between CSR actions and firm's performance. AIMS Environ Sci. 2020;7(6):542-58. https://doi.org/10.3934/environsci.2020034

3. Nazzaro C, Stanco M, Marotta G. The life cycle of corporate social responsibility in agri-food: Value Creation Models. Sustainability. 2020;12(4):1287. https://doi.org/10.3390/su12041287

4. Sarajoti P, Chatjuthamard P, Papangkorn S, Phiromswad P. CSR Reporting and Blockchain Technology. IntechOpen. 2023. doi:10.5772/intechopen.105512

5. Kaplan A, Haenlein M. Rulers of the world, unite! The challenges and opportunities of the metaverse. Bus Horiz. 2022;65(5):647-59. https://doi.org/10.1016/j.bushor.2022.05.006

6. Freeman RE. Strategic management: A stakeholder approach. Boston: Pitman; 1984.

7. Aguinis H, Glavas A. What we know and don't know about corporate social responsibility: A review and research agenda. J Manag. 2012;38(4):932-68. https://doi.org/10.1177/0149206311436079

8. Turker D. Measuring corporate social responsibility: A scale development study. J Bus Ethics. 2009;85(4):411-27. https://doi.org/10.1007/s10551-008-9780-6

9. Ali W, Danni Y, Latif B, Kouser R, Baqader S. Corporate social responsibility and customer loyalty in food chains, mediating role of customer satisfaction and corporate reputation. Sustainability. 2021;13:8681. https://doi.org/10.3390/su13168681

10. Spyrou O, Ariza Sentís M, Vélez S. Enhancing Education in Agriculture via XR Based Digital Twins: A Novel Approach for the Next Generation. Appl Syst Innov. 2025;8(2):38.

11. Boccia F, Covino D. Knowledge and Food Sustainability: the Metaverse as a New Economic-Environmental Paradigm. J Knowl Econ. 2024;15:14841-54. https://doi.org/10.1007/s13132-023-01626-w

12. Bebbington J, Unerman J, O'Dwyer B. Sustainability accounting and accountability. Routledge; 2020. https://doi.org/10.4324/9780429291280

13. Sprinkle GB, Maines LA. The benefits and costs of corporate social responsibility. Bus Horiz. 2010;53(5):445-53. https://doi.org/10.1016/j.bushor.2010.05.006

14. Simionescu LN, Dumitrescu D. Empirical Study towards Corporate Social Responsibility Practices and Company Financial Performance. Evidence for Companies Listed on the Bucharest Stock Exchange. Sustainability. 2018;10:3141. https://doi.org/10.3390/su10093141

15. Biró K, Szalmáné Csete M. Corporate social responsibility in agribusiness: climate-related empirical findings from Hungary. Environ Dev Sustain. 2021;23:5674-94. https://doi.org/10.1007/s10668-020-00838-3

16. Yu Y, Huo B. The impact of environmental orientation on supplier green management and financial performance: The moderating role of relational capital. J Clean Prod. 2019;211:628-39. https://doi.org/10.1016/j.jclepro.2018.11.198

17. Rathore S, Arora M. Sustainability reporting in the metaverse: A multi-sectoral analysis. In: Kumar J, et al., editors. Exploring the Use of Metaverse in Business and Education. IGI Global Scientific Publishing; 2024. p.147-65. https://doi.org/10.4018/979-8-3693-5868-9.ch009

18. Creswell JW, Creswell JD. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed. Sage Publications; 2018.

19. Rashid N, Wan Ismail WNS, Abd Rahman MS, Afthanorhan A. Conceptual analysis on performance measurement used in SMEs research: The effectiveness of firm's overall performance. Int J Acad Res Bus Soc Sci. 2018;8(11):5199. https://doi.org/10.6007/IJARBSS/v8-i11/5199

20. Dwivedi YK, Hughes L, Baabdullah AM, Ribeiro-Navarrete S, Giannakis M, Al-Debei MM, Dennehy D, Metri B, Buhalis D, Cheung CMK, Conboy K, Doyle R, Dubey R, Dutot V, Felix R, Papagiannidis S, Pappas IO, Rana NP, Sharma SK. Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. Int J Inf Manage. 2022;66:102542. https://doi.org/10.1016/j.ijinfomgt.2022.102542

21. Suganthi L. Examining the relationship between corporate social responsibility, performance, employees' pro-environmental behavior at work with green practices as mediator. J Clean Prod. 2019;232:739-50. https://doi.org/10.1016/j.jclepro.2019.05.295

22. Nunnally JC. Psychometric Theory. 2nd ed. New York: McGraw-Hill; 1978.

23. Rahman N, Rashid N, Majid AHA. Corporate social responsibility and financial performance: A study of Malaysian companies. Procedia Soc Behav Sci. 2014;164:98-104. https://doi.org/10.1016/j.sbspro.2014.11.054

24. Hafez M. The impact of sustainable farming on consumer trust and loyalty: Evidence from the agricultural sector. J Sustain Agric Environ. 2018;23(2):115-28.