Foresight in Sports Businesses: Exploring Emerging Scenarios Based on AI-Language Models and Financial Management Strategies

Foresight of Sports Businesses Using AI-Language Models and Financial Strategies

ABSTRACT

Purpose: The study explores the application of AI language models in scenario planning and financial management strategies for sports businesses.
Design/methodology/approach: This research utilizes a comprehensive scenario planning approach, guided by the Shell Scenario Method, which includes five key stages: (1) current and future perception assessment, (2) identification of driving forces, (3) visualization of future headlines and scenario elements, (4) analysis of scenario implications, and (5) formulation of strategic options. AI language models such as GPT-4 and BERT replaced traditional human stakeholders, generating detailed insights and scenario narratives based on data analysis.
Findings: The findings indicate that AI language models significantly enhance the efficiency and accuracy of scenario planning in sports businesses. By analyzing large datasets, these models predict emerging trends and potential disruptions in fan behavior, technological adoption, and revenue generation. The study presents four future scenarios for the sports industry: AI-powered innovation, sustainability focus, consumer-centric tech, and traditional resilience. These scenarios provide practical insights for organizations to anticipate changes and prepare strategic responses for the next decade.
Originality: The originality of this study lies in replacing human expertise with AI language models for scenario planning, offering a more efficient and data-driven approach to forecasting. Furthermore, the unique scenarios developed provide valuable foresight for sports organizations to align their strategies with future industry dynamics, particularly in adapting to technological advancements and shifting consumer demands.

Keywords

AI language Models; Financial Strategies; Foresight; Scenario Planning; Sports Businesses.

Paper type
Original Article

آینده‌نگاری کسب‌وکارهای ورزشی: بررسی سناریوهای نوظهور بر اساس مدل‌های زبانی هوش مصنوعی و راهبردهای مدیریت مالی

آینده‌نگاری کسب‌وکارهای ورزشی با مدل‌های زبانی هوش مصنوعی و راهبردهای مالی

چکیده

هدف: این مطالعه به بررسی کاربرد مدل‌های زبانی هوش مصنوعی در برنامه‌ریزی سناریو و استراتژی‌های مدیریت مالی در کسب‌وکارهای ورزشی می‌پردازد.

روش: این پژوهش از رویکرد جامع برنامه‌ریزی سناریو با استفاده از روش برنامه‌ریزی سناریوی Shell بهره می‌گیرد که شامل پنج مرحله کلیدی است: (۱) ارزیابی برداشت‌های فعلی و آینده، (۲) شناسایی نیروهای محرکه، (۳) تجسم عناوین آینده و عناصر سناریو، (۴) تحلیل پیامدهای سناریو و (۵) تدوین گزینه‌های استراتژیک. مدل‌های زبانی هوش مصنوعی نظیر GPT-4 و BERT به‌جای ذینفعان انسانی سنتی به‌کار گرفته شدند تا براساس تحلیل داده‌ها، بینش‌ها و روایات سناریویی دقیقی ارائه دهند.

یافته‌ها: نتایج نشان می‌دهد که مدل‌های زبانی هوش مصنوعی به‌طور قابل توجهی دقت و کارایی برنامه‌ریزی سناریو را در کسب‌وکارهای ورزشی بهبود می‌بخشند. این مدل‌ها با تحلیل مجموعه داده‌های بزرگ، روندهای نوظهور و اختلالات احتمالی در حوزه‌هایی نظیر رفتار هواداران، پذیرش فناوری و تولید درآمد را پیش‌بینی می‌کنند. چهار سناریوی آینده برای صنعت ورزش ارائه شده است: نوآوری مبتنی بر هوش مصنوعی، تمرکز بر پایداری، فناوری مشتری‌محور و مقاومت سنتی. این سناریوها بینش‌های کاربردی برای سازمان‌ها فراهم می‌آورند تا تغییرات را پیش‌بینی کرده و پاسخ‌های استراتژیک برای دهه آینده آماده کنند.

اصالت و ابتکار مقاله: اصالت این مطالعه در جایگزینی تخصص انسانی با مدل‌های زبانی هوش مصنوعی برای برنامه‌ریزی سناریو است که رویکردی کارآمدتر و مبتنی بر داده برای پیش‌بینی ارائه می‌دهد. علاوه بر این، سناریوهای منحصر به‌فرد توسعه‌یافته، بینش‌های ارزشمندی را برای کسب‌وکارهای ورزشی فراهم می‌کنند تا استراتژی‌های خود را با پویایی‌های آینده صنعت، به‌ویژه در زمینه تطبیق با پیشرفت‌های فناوری و تغییرات رفتار مصرف‌کننده، هماهنگ کنند.

کلید واژه

استراتژی‌های مالی؛ آینده‌نگاری؛ برنامه‌ریزی سناریو؛ کسب‌وکارهای ورزشی، مدل‌های زبانی هوش مصنوعی.

1. Introduction

Over the past decade, the sports industry has undergone significant transformations due to advancements in Artificial Intelligence (AI), Machine Learning (ML), and data analytics. These technologies are reshaping both on-field athletic performance and off-field business operations, including fan engagement strategies (Lu, Yang, & Li, 2024; Naughton et al., 2024). AI is now commonly utilized to optimize athlete training schedules, analyze performance during games, and predict potential injuries. This data-driven methodology has equipped sports organizations with valuable tools to improve decision-making, enhance operations, and offer more personalized experiences for fans (Wang et al., 2024). Such advancements are pushing sports organizations to rethink traditional strategies and adopt innovative methods to stay competitive on and off the field (Dupuit et al., 2023).

In recent years, there has been an increasing dependence on AI-driven models to refine business strategies, boost athlete performance, and enhance fan engagement within the sports industry (Rauschecker et al., 2020). Technologies like AI-powered chatbots, wearable devices, and augmented reality are now employed to deliver immersive experiences for fans and to automate multiple operational tasks (Ferrucci et al., 2010). In addition, ML models are being used to predict attendance trends and optimize ticket pricing strategies, contributing significantly to revenue generation for sports organizations (Chan, Hogaboam, & Cao, 2022). These innovations emphasize the transition to a more data-driven approach, establishing AI as a crucial tool for both technical and business decision-making (Chan, Hogaboam, & Cao, 2022; Rauschecker et al., 2020).

Foresight is crucial for sports organizations to anticipate future trends, adapt to technological disruptions, and align strategic goals with evolving industry dynamics (Sossa et al., 2024). Scenario analysis has become a critical tool, allowing sports organizations to anticipate future trends, mitigate risks, and remain flexible in today's rapidly evolving technological landscape (Geissler et al., 2024; Zhang et al., 2025). Understanding disruptions caused by AI and data analytics is essential, as these technologies can enhance scenario planning and performance management (Yildiz, Eroglu-Eskicioglu, & Yildiz, 2024; Özbey, 2024). This creates opportunities for incorporating AI language models like GPT and BERT to enhance strategic foresight and improve decision-making.

Language models like GPT-3 and GPT-4 have revolutionized data analysis and insight generation, especially in fields relying on complex forecasting, such as sports (Bonab & Yazdani-Asrami, 2025). These models can analyze vast amounts of unstructured data in real time, revealing subtle patterns from sources such as social media and fan feedback, which makes them essential for scenario planning (Mukhtar, 2025; Thomas, 2025). Compared to traditional methods, these models offer faster adaptability, reduce reliance on biased human expertise, and enable more inclusive decision-making by synthesizing diverse viewpoints (Jadhav et al., 2024) Therefore, AI language models serve not only as tools for generating scenarios but also as active

contributors to strategic planning, improving the accuracy of foresight and the agility of decision-making (Chan, Hogaboam, & Cao, 2022; Grzybowski, Pawlikowska–Łagód, & Lambert, 2024). Consequently, they enable sports organizations to make more informed and agile decisions in a rapidly evolving environment.

Integrating advanced AI language models like GPT-3 and GPT-4 has significantly enhanced the accuracy and efficiency of foresight in the sports industry. These models can analyze massive datasets, including market trends and social media insights, uncover hidden patterns, and simulate future scenarios to help organizations make proactive strategic decisions (Yan et al., 2024; Zhu et al., 2023). This capability allows sports organizations to predict technological impacts and optimize resources for effective long-term planning.

AI language models also reduce dependence on traditional foresight methods, which are time-consuming and prone to bias (Liu, 2024). Their adaptability and real-time learning ensure strategic plans stay relevant in dynamic environments. Proven effective in other industries like healthcare and finance, these models support precise scenario planning and comprehensive decision-making by incorporating diverse variables(Bonsu, Dhubháin, & O'Connor, 2017; Katz, Shakir, & Chambers, 2023). Thus, they offer a robust framework for sports organizations to anticipate and manage uncertainties effectively.

Recent research has significantly advanced the use of AI and machine learning models in sports management, focusing on techniques like supervised, unsupervised, and reinforcement learning for performance analysis and predictive modeling (Guo & Li, 2021). However, most studies emphasize short-term outcomes rather than long-term foresight, limiting the integration of AI in strategic scenario planning (Hong & Ren, 2022). Furthermore, ethical and governance issues are still inadequately addressed, complicating the development of comprehensive frameworks for sustainable AI use in sports (Guilherme, 2019; Hsieh & Shannon, 2005).

Current research strengths lie in generative AI models and hybrid approaches that support performance forecasting (Huang, Huang, & Wang, 2021). Yet, gaps persist in applying these models to scenario-based foresight, which is crucial for handling uncertainties in the sports industry. There is a need to develop robust, ethics-oriented foresight models that align AI's capabilities with strategic goals, integrating stakeholder perspectives for comprehensive scenario planning (Butterworth, 2018). Such frameworks could better position sports organizations to anticipate and adapt to future trends.

One of the strengths of current research is the development of generative AI models and hybrid approaches that have proven effective in performance forecasting and strategic management (Hinojosa et al., 2018; Huang, Huang, & Wang, 2021) . However, there are still gaps in applying these models for scenario-based foresight, essential for managing uncertainty in the sports industry. Additionally, while some research has examined the ethical aspects of AI, it often fails to provide practical solutions to balance technological potential with moral concerns (Butterworth, 2018). This underscores the necessity for future research to connect AI's technical abilities

with its strategic potential by creating strong, ethics-focused foresight models that incorporate stakeholder viewpoints (Boldt & Orrù, 2022). Such models could better align AI's technological benefits with long-term strategic goals in sports management, thus offering a more comprehensive framework for anticipating and adapting to future industry trends.

A review of current research on foresight and the use of AI in sports management identifies significant gaps. While numerous studies have concentrated on AI for performance analysis and short-term predictions like game outcomes, there is an apparent deficiency in research incorporating AI-based language models into long-term scenario planning and strategic forecasting. This is especially apparent in the use of models like GPT for simulating complex future scenarios related to market trends, fan behavior, and potential disruptions. The lack of a comprehensive framework restricts the practical application of foresight in actual sports contexts. Therefore, this study addresses these gaps by developing a systematic approach that leverages AI language models for scenario planning, offering a strategic tool for sports management.

This study advances sports business foresight by integrating AI language models into scenario planning. Traditional foresight relies on expert judgment, but models like GPT offer a more systematic and efficient way to predict complex scenarios. By addressing research gaps, this study demonstrates how these models can improve foresight accuracy and provide insights into emerging trends in the sports industry. The research develops a comprehensive framework for practical AI application in strategic planning, aiding sports organizations in navigating uncertainties more effectively.

Despite significant advancements in AI technologies and their applications in the sports industry, current foresight practices heavily rely on traditional expert-based methods that are time-consuming, biased, and often lack scalability. While AI tools like machine learning have been widely used for short-term performance analytics and predictive modeling, their application in long-term strategic foresight remains underexplored. Furthermore, the lack of integration between AI language models (e.g., GPT-3 and GPT-4) and financial management strategies creates a critical gap in scenario-based planning. This limitation hampers sports organizations' ability to effectively predict and adapt to emerging market trends, technological disruptions, and shifting consumer behaviors. Addressing this issue requires developing a robust, ethics-oriented, and adaptable framework that leverages the unique capabilities of AI language models for strategic foresight, offering sports organizations a competitive edge in an increasingly dynamic environment.

The research centers on leveraging AI-based language models for scenario analysis and foresight to shape the future of sports enterprises. It aims to investigate how these models can forecast emerging trends, enhance financial strategies, and assist sports organizations in creating effective, proactive responses. The study connects AI capabilities with practical foresight by developing a strategic framework for long-term planning, allowing businesses to manage uncertainties and improve their adaptability

for future growth in the sports sector. The research's goal is to thoroughly address the challenges in Foresight of Sports Businesses and Analyzing Emerging Scenarios Using AI-Language Models and Financial Management Strategies.

2. Theoretical background

The theoretical framework covers three main areas: foresight in sports business financial management strategies, and AI language models. Each section demonstrates its role in strategic planning for sports organizations. By integrating AI into foresight and financial management, this framework provides a structured approach to addressing uncertainties and predicting future trends in the sports industry, ensuring better decision-making and strategic alignment.

2.1. Foresight in Sports Business

Foresight is the organized approach to predicting future trends and potential disruptions that may affect an organization or industry. In the realm of sports business, it is employed to assess emerging market trends, technological innovations, and shifts in consumer behavior that could impact the strategic direction of sports organizations. This process typically involves trend scanning, scenario planning, and Delphi studies to build a structured understanding of possible futures. According to various frameworks such as scenario management and strategic foresight models, sports organizations use foresight to proactively identify opportunities and threats, enhancing their agility and long-term competitiveness (Rohrbeck & Gemünden, 2011). Additionally, foresight techniques can help organizations navigate uncertainties by constructing diverse scenarios and aligning their strategies to optimize decision-making (Leitner, 2020).

Several foresight models are used in strategic planning within the sports industry. Scenario management develops multiple future scenarios to address uncertainties, making organizations more resilient (Rohrbeck & Gemünden, 2011). Technology foresight assesses the impact of emerging technologies on business practices, identifying growth opportunities (Barker & Smith, 1995). These models guide strategic planning and ensure competitiveness in a dynamic market (Battistella & De Toni, 2012). Foresight is crucial for predicting disruptions and capitalizing on opportunities in long-term management (Wilkinson & Kupers, 2013).

2.2. Financial Management Strategies

Financial management strategies in sports businesses typically encompass budgeting, investment planning, and risk management. Effective budgeting enables sports organizations to allocate their resources efficiently, balancing expenses related to player salaries, infrastructure, marketing, and operational costs(Giannessi, 1958; Graham & Rogers, 2002; Haghparast, Soltan Hoseini, & Nasr Esfahani, 2024). Investment strategies are also crucial, particularly in decisions involving capital expenditures for new facilities, technological innovations, and talent acquisition, all

of which contribute to long-term sustainability and competitive advantage(Henri, 2016). Moreover, risk management strategies help organizations mitigate financial uncertainty by employing hedging techniques, such as derivatives, and adopting diversified investment portfolios to safeguard against economic downturns (Ho et al., 2018).

Financial scenario analysis helps sports organizations evaluate potential outcomes under different economic conditions by creating scenarios ranging from optimistic to worst-case (Hertzel & Officer, 2012; Kharchenko & Ziming, 2021). This method aids decision-making by identifying resilient strategies and assessing the impact of variables like revenue fluctuations and unexpected costs. Incorporating sustainability measures enhances resilience against regulatory and environmental risks (Nielsen, Sarasoja, & Galamba, 2016). Ultimately, scenario analysis enables proactive planning, ensuring preparedness and the ability to capitalize on opportunities (Kassi et al., 2019; Kennerley & Neely, 2002).

2.3. AI-Language Models

AI language models like GPT (Generative Pre-trained Transformer) and BERT (Bidirectional Encoder Representations from Transformers) have transformed natural language processing. They are extensively used in predictive analytics and scenario planning. Developed by OpenAI, GPT models utilize transformer architecture to generate coherent, human-like text. In contrast, BERT focuses on understanding context, excelling in tasks such as text classification and sentiment analysis, and is particularly useful for gleaning insights from large text datasets (Ferrucci et al., 2010; Radford, 2018).

These models are increasingly being adopted as alternatives to conventional information-gathering methods like surveys and expert panels. Unlike traditional approaches that depend heavily on human input, language models can analyze large datasets in real time, offering quicker and more comprehensive insights. This capability makes them especially valuable in strategic planning, as they can simulate various future scenarios, assess market trends, and predict consumer behaviors more accurately than traditional methods (Vinyals et al., 2019). Their capability to adapt to new data and generate predictions on complex trends enables organizations to stay agile and make informed decisions even under uncertain conditions.

The theoretical framework includes foresight, financial management, and AI language models as core concepts, illustrating their role in strategic planning. Foresight anticipates industry changes, financial strategies handle resource management, and AI models enhance predictive capabilities. Together, these elements create a strong basis for incorporating AI into sports business management, facilitating effective scenario planning and decision-making and directing future strategic research.

3. Methodology

This study adopts an interpretive philosophical approach within an inductive framework, as outlined by Okasha (2016) De Haro (2020). The methodology utilizes a data-driven approach to develop scenarios without predefined categories, enabling a flexible framework to anticipate future developments in the sports industry. This approach identifies emerging trends, addresses uncertainties, and proposes strategic pathways for effectively managing these dynamics.

The study's innovation lies in employing AI language models, such as GPT-4 and BERT, for data analysis and scenario development. These models analyze vast datasets, identify patterns, and generate structured narratives, providing a scalable and unbiased alternative to traditional stakeholder-driven methods. Traditional scenario planning methods involve stakeholders such as policy-makers, market analysts, and industry experts to gather diverse perspectives (Bonsu, Dhubháin, & O'Connor, 2017; Jansen et al., 2023). In contrast, this study employs advanced AI models such as GPT-4, BERT, and T5 to replicate human expertise and simulate complex scenarios. These models are characterized by their ability to process vast datasets, identify patterns, and generate structured narratives with efficiency, scalability, and neutrality that surpasses traditional methods.

The data sources utilized for training the AI language models and for scenario development in this research are diverse and carefully curated to ensure relevance and comprehensiveness. For the training of the AI models like GPT-4 and BERT, vast publicly available datasets were leveraged, including Common Crawl, Wikipedia, scientific articles, and other high-quality text corpora. These datasets provide a broad foundation of knowledge, enabling the models to generate insights and scenarios across various domains, including sports management. While these pre-trained models were not explicitly trained on sports-related data, they were fine-tuned using domain-specific datasets, such as industry reports, market analyses, and academic literature focused on sports business trends, fan behavior, and technological advancements.

For scenario development, secondary data sources were employed, including reports from prominent consulting firms, regulatory bodies, and sports organizations. Social media analytics were also integrated to capture real-time fan sentiment and emerging trends. Despite the robustness of these sources, certain limitations must be acknowledged. For instance, publicly available datasets may contain inherent biases, and domain-specific datasets may not fully capture the nuances of rapidly evolving trends in the sports industry. Moreover, the reliance on secondary data sources introduces potential gaps in empirical validation, which were mitigated through cross-referencing with existing literature. These limitations highlight the importance of cautious interpretation and iterative validation of AI-generated outputs to ensure reliability and alignment with real-world dynamics.

Research Methodology Steps

Data Input: Key questions typically posed to human experts were directed to AI models instead. These questions were designed to elicit insights on trends, challenges, and potential future scenarios in the sports industry.

Data Processing: AI models analyzed a wide array of datasets, including industry reports, academic literature, and social media insights, to provide comprehensive responses to the posed questions.

Scenario Development: Based on the AI-generated responses, multiple future scenarios were constructed, capturing diverse perspectives on technological advancements, financial strategies, and market dynamics.

Validation: To ensure the reliability and relevance of the findings, the AI-generated scenarios were reviewed and compared to existing literature and cross-referenced for consistency.

The AI language models used in this study include various advanced tools; each selected for its specific strengths in text generation, contextual understanding, and trend analysis. Table 1 provides an overview of the AI models used in this research and their roles in the scenario planning process.

Table 1. AI language models utilized in the study.

No.	AI Model	Developer	Core Functionality
1	GPT-4	OpenAI	Scenario simulation, natural text generation
2	BERT	Google	Contextual understanding and language comprehension
3	Roberta	Facebook AI	Enhanced sentiment analysis, text classification
4	T5	Google	Versatile Multi-task across NLP tasks
5	XLNet	Google	Managing dependencies in long text sequences
6	DistilGPT-2	OpenAI	Lightweight, efficient for smaller tasks
7	ERNIE	Baidu	Contextual deep learning with integrated knowledge
8	Turing-NLG	Microsoft	Advanced text creation for strategic planning

Following the overview provided in Table 1, it is essential to delve deeper into the specific AI language models utilized and their roles in this research. GPT-4, developed by OpenAI, was pivotal in generating coherent and contextually rich scenario simulations and natural language narratives, enabling a comprehensive exploration of future scenarios in the sports industry. BERT, created by Google, excels in understanding the nuances of textual context, making it invaluable for analyzing unstructured data and identifying critical trends. Roberta, an enhanced version of BERT by Facebook AI, was employed for sentiment analysis and classification tasks, particularly in evaluating stakeholder perceptions and fan engagement data. T5, also by Google, offered versatile multitasking capabilities across various natural language processing (NLP) tasks, supporting tasks like data summarization and scenario synthesis. XLNet, another advanced model by Google, effectively managed dependencies in long-text sequences, which was critical for analyzing extensive datasets and maintaining coherence in scenario narratives. DistilGPT-2, a lightweight and efficient variant of GPT models by OpenAI, was instrumental in handling minor, more targeted NLP tasks, such as refining specific components of scenario narratives. ERNIE, developed by Baidu, integrated domain-specific knowledge into its deep

contextual understanding, enriching the research with insights tailored to the sports business domain. Finally, Turing-NLG from Microsoft demonstrated its advanced capabilities in generating complex strategic planning texts, allowing for the formulation of detailed and actionable recommendations for each scenario. Together, these models formed a robust and synergistic framework, enabling precise, data-driven foresight analysis tailored to the unique demands of the sports business ecosystem. Integrating these AI models enables the study to simulate complex future scenarios and predict long-term trends without relying on human-generated data. This innovative approach provides a comprehensive framework for strategic foresight, using the capabilities of each model to anticipate the impact of emerging technologies and financial strategies on the sports industry.

Building on the steps outlined in Figure 1 and the Shell Scenario Method (Sunitiyoso et al., 2023), this study's methodology involved several vital phases: (1) assessing the current and projected views of stakeholders, (2) pinpointing the major driving forces and critical uncertainties, (3) outlining the key elements and future scenarios, (4) determining the potential implications, and (5) devising strategic options tailored for each scenario.

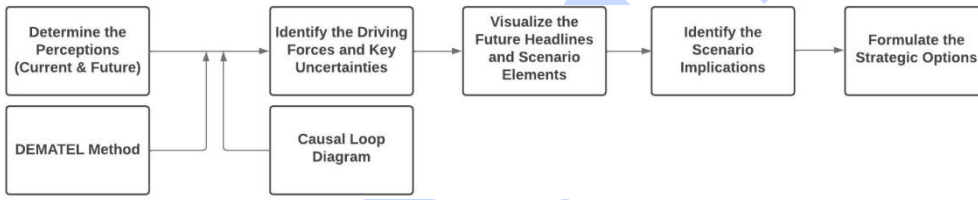

Figure 1. Scenario planning methodology(Sunitiyoso et al., 2023).

Stage 1: Determine the Current and Future Perceptions

In traditional scenario planning, stakeholders from various backgrounds contribute their insights on the industry's status and prospects. In this study, however, we employ AI models as virtual stakeholders to analyze historical data, industry reports, and market trends. Each AI model is designated a specific role to simulate the perspectives of investors, analysts, and strategists. This approach enables a thorough understanding of the current landscape and helps anticipate future developments in the sports business ecosystem (Table 2: AI Language Models as Virtual Participants).

Table 2. AI language models as virtual participants.

No.	AI Model	Role in Research	Key Strength
1	GPT-4	Scenario generation and text synthesis	Advanced text generation and scenario simulation
2	BERT	Contextual analysis and classification	Contextual understanding and classification
3	Roberta	Sentiment analysis and trend prediction	High accuracy in sentiment and trend analysis
4	T5	Multi-tasking text-based analysis	Multi-tasking for various text-based applications
5	XLNet	Long-form dependency analysis	Handling long-term dependencies in text analysis
6	DistilGPT-2	Lightweight data processing	Lightweight and faster processing
7	ERNIE	Knowledge contextualization	Knowledge integration for deep contextualization
8	Turing-NLG	Complex scenario planning	Text generation for complex scenario planning

We employ these models to gather AI-generated insights that mirror human inputs, providing a robust alternative to traditional methods.

Stage 2: Identify the Driving Forces and Key Uncertainties

The AI models are employed to classify and prioritize the key factors influencing the future of sports businesses, including technological disruptions, financial management strategies, and changes in consumer preferences. By utilizing context-aware models like Roberta and GPT-4, the research identifies critical uncertainties (such as adopting new AI technologies) and predetermined elements (like demographic trends). These insights serve as a foundation for creating various scenario narratives.

For this stage, we utilized AI models such as Roberta and GPT-4 to analyze various datasets, including market reports, academic studies, and technological trend analyses. The models classified and prioritized the most significant driving forces impacting the future of the sports industry, such as technological disruptions, shifts in consumer behavior, and advancements in financial management strategies. Key uncertainties, such as the adoption rate of emerging AI technologies, were identified through context-aware analysis. This step ensured that the study captured both predictable elements and areas of high uncertainty, forming a solid foundation for scenario development.

Stage 3: Visualize the Future Headlines and Scenario Elements

This step involves using text generation models such as T5 and Turing-NLG to create distinct scenario narratives for the future of sports businesses. Each model generates future headlines and detailed scenario descriptions, incorporating technological innovations and financial risk management strategies. The goal is to explore various plausible futures that account for changes in fan engagement, market dynamics, and technological adoption.

We employed text-generation models like T5 and Turing-NLG during this phase to create diverse scenario narratives. These models synthesized information from previously identified driving forces and uncertainties to generate plausible future headlines and scenario descriptions. The process involved integrating trends such as technological adoption, fan engagement, and market dynamics into coherent narratives. By simulating various outcomes, this stage provided a detailed exploration of how potential developments could shape the sports business ecosystem.

Stage 4: Identify the Implications

Each scenario is examined for its implications in several areas, such as financial performance, fan engagement, and market strategy. The AI models integrate data from numerous sources to assess the effects of each scenario on the sports business ecosystem, offering insights that can inform strategic planning.

In this stage, AI models such as GPT-4 and Roberta were used to analyze the implications of each scenario across several critical areas, including financial performance, fan engagement, and market strategies. The models synthesized data

from multiple sources to assess how each scenario would affect sports organizations and their operations. This analysis provided actionable insights into the risks and opportunities associated with each potential future, enabling a deeper understanding of the strategic implications.

Stage 5: Formulate Strategic Options

Finally, strategic recommendations are formulated for each scenario using GPT-4 and Turing-NLG. The AI models generate flexible strategies tailored to each scenario, considering factors like investment in new technologies, marketing shifts, and operational adjustments. This step ensures that sports organizations are well-prepared to adapt to emerging trends and navigate future uncertainties.

This AI-driven scenario planning methodology provides a comprehensive and data-driven framework for anticipating and managing the future of sports businesses, ensuring that organizations remain competitive in a rapidly evolving environment.

To finalize the process, we used GPT-4 and Turing-NLG to generate strategic recommendations tailored to each scenario. The models created flexible strategies, addressing key considerations such as investments in new technologies, adapting marketing approaches, and making operational adjustments. Each plan was designed to provide sports organizations with the tools to effectively navigate emerging trends and uncertainties. This step ensured that the scenario planning process concluded with practical, actionable strategies to guide decision-making.

4. Results

This section presents the detailed development of future scenarios for the sports industry, utilizing AI language models to simulate and anticipate critical dynamics. Drawing from the AI models' analysis, we examine current obstacles, future challenges, driving forces, relationships between those forces, and scenario elements that could shape the industry's future by 2030. AI language models identified various significant obstacles and challenges confronting sports businesses. The models generated insights into both short-term and long-term issues by analyzing an array of data points, including market trends, consumer behavior, and financial strategies. These findings are summarized in Table 3 below.

Table 3. Current obstacles and future challenges in the sports industry.

Topics	No. of Keywords (Current Obstacles)	No. of Keywords (Future Challenges)
Financial instability and revenue gaps	22	18
Technology adaptation and AI integration	20	22
Regulatory barriers and policy inconsistencies	15	10
Fan engagement and changing consumer behavior	14	20
Sponsorship models and business partnerships	10	15
Environmental sustainability and green technologies	8	12
Market globalization and competition	5	7

Table 3 highlights key challenges in the sports industry, such as financial instability, AI integration, and changing fan behaviors. These findings emphasize the need for innovative strategies to address revenue gaps and adapt to evolving market demands.

Additionally, adapting to technology—especially integrating AI—presents both challenges and opportunities for organizations aiming to update their operations. Fan engagement is another crucial factor, as changing consumer behaviors requires developing new strategies to attract and retain audiences. AI integration remains a key theme for future challenges, as businesses seek to utilize AI for improved decision-making and scenario planning. Additionally, focusing on environmental sustainability is becoming essential due to regulations and consumer expectations. The AI language models also identified several key driving forces that will influence the future of sports businesses, including technological, economic, social, and environmental factors, each evaluated for its potential impact on the industry. Table 4 provides an overview of the driving forces identified.

Table 4. Driving forces influencing the future of the sports industry.

Driving Forces	Occurrences	Specific Aspects
Technological disruptions (AI, VR, and AR)	22	AI-powered analytics, Virtual/Augmented Reality
Shifts in fan behavior and preferences	18	Fan loyalty, digital engagement, content personalization
Revenue diversification and new business models	17	AI-driven revenue streams, NFTs, blockchain in sports
Regulatory changes and governance	15	Data privacy laws, digital rights management
Environmental sustainability and green technologies	14	Carbon footprint reduction, sustainable stadiums
Globalization and competition in sports markets	12	Expanding global fanbase, international competitions
Financial management and investment strategies	11	Sponsorship shifts, economic volatility

Important driving forces, such as technological disruption—primarily through AI, Virtual Reality (VR), and Augmented Reality (AR)—are anticipated to change the operations of sports businesses fundamentally. Additionally, shifts in fan behavior, including a growing demand for personalized content and digital engagement, will compel sports organizations to reevaluate their engagement strategies. Furthermore, revenue diversification through new business models like non-fungible tokens (NFTs) and blockchain-based ownership is set to transform how these businesses generate income. The AI models evaluated their relative importance to understand better how these driving forces will interact in the future. They identified the most significant forces that will drive change in the sports industry. Table 5 outlines these selected driving forces and their projected impact.

Table 5. Selected driving forces in the sports industry.

Code	Driver	Impact Level (Rx+Cy)
TD	Technological disruption and AI integration	1.7
FB	Fan behavior and preferences	1.4
RD	Revenue diversification	1.3

RG	Regulatory governance	1.1
ES	Environmental sustainability	1.0
FM	Financial management strategies	0.9

The fundamental factors, primarily technological advancements and evolving fan preferences, are anticipated to shape the sports sector's trajectory significantly. This high-impact assessment indicates that companies must embrace innovation and flexibility to stay ahead. To better understand the interplay of these elements, AI algorithms generated a causal loop diagram (CLD), as depicted in Table 6, elucidating the intricate causal connections.

Table 6. Relationships between the selected driving forces.

Code	TD	FB	RD	ES	RG	FM
TD	0	1	0.8	0.6	0.5	0.4
FB	1	0	0.7	0.5	0.4	0.3
RD	0.8	0.7	0	0.6	0.5	0.4
ES	0.6	0.5	0.6	0	0.3	0.2
RG	0.5	0.4	0.5	0.3	0	0.3
FM	0.4	0.3	0.4	0.2	0.3	0

This table highlights the interdependence of the driving forces, with Technological Disruption (TD) strongly influencing Fan Behavior (FB) and Revenue Diversification (RD). These connections suggest that adopting new technologies could dramatically reshape both revenue generation and fan engagement strategies. Table 7 outlines four future scenarios shaped by technological disruptions, fan preferences, and sustainability initiatives. Each scenario offers unique insights into how sports organizations might adapt to these forces, providing a roadmap for strategic decision-making.

Table 7. Scenario elements in the future of the sports industry.

Key Drivers	Scenario 1: AI-Powered Innovation	Scenario 2: Sustainability Focus	Scenario 3: Consumer-Centric Tech	Scenario 4: Traditional Resilience
Technological disruption	Full AI integration in sports strategy	Limited AI use, focus on green tech	AI used for personalized fan engagement	Minimal AI use, reliance on traditional methods
Fan behavior	Highly personalized, AI-driven experiences	Environmentally conscious fan base	Consumers demand tech innovation	Fans prefer traditional sports experiences
Revenue models	New AI-driven revenue streams	Revenue focused on eco-friendly practices	AI-powered revenue diversification	Reliance on established revenue streams
Environmental sustainability	Moderate environmental considerations	High focus on sustainability practices	Sustainability integrated as a secondary factor	Sustainability initiatives underdeveloped
Regulatory governance	Strong data privacy and AI regulations	Strict environmental regulations	Flexible tech governance	Light regulatory framework

Each scenario presents a distinct vision for the future of the sports industry, driven by varying levels of AI integration, environmental sustainability, and evolving fan

preferences. Scenario 1 envisions an industry fully embracing AI for innovation, while Scenario 4 depicts a future where the implications of traditional practices are considered.

Scenario 1: AI-Powered Innovation

In this scenario, artificial intelligence (AI) is fully integrated across all aspects of sports management, drastically transforming how organizations operate. From performance analytics to fan engagement, AI tools such as GPT-4 and BERT enable Sports Businesses to make data-driven decisions that enhance the athlete and fan experience. Advanced predictive models help forecast game outcomes, improve player training routines, and provide personalized fan services, including real-time merchandise recommendations and dynamic ticket pricing based on individual preferences. Advanced AI systems revolutionize sports management, offering innovative strategies to boost revenue. By integrating AI, sports entities can develop cutting-edge solutions, prioritizing technological innovation to stay ahead in the market, all while keeping an eye on environmental sustainability (Christensen, Raynor, & McDonald, 2015).

Scenario 2: Sustainability Focus

In this scenario, sports Businesses prioritize environmental sustainability, utilizing AI to manage energy efficiency and carbon emissions. These AI systems assist in adhering to eco-friendly regulations and reducing the environmental impact of sports venues. The technology aids renewable energy management, aligning with government policies and consumer preferences for eco-conscious practices. While AI's role in fan interaction is limited here, it is essential for achieving sustainability targets, gaining fan approval, and meeting regulatory expectations (Cury, Kennelly, & Howes, 2023).

Scenario 3: Consumer-Centric Tech

In this scenario, the focus shifts toward creating highly personalized, tech-driven experiences for fans. AI models are employed to analyze fan preferences and deliver tailored services, from interactive virtual reality experiences to personalized in-game betting opportunities. AI-powered recommendation engines offer fans customized content, merchandise, and immersive digital experiences. Revenue models are diversified through these AI-driven innovations, ensuring that organizations can cater to tech-savvy fans who demand a seamless and engaging experience. While environmental sustainability is secondary in this scenario, AI remains critical for maximizing fan engagement and driving new revenue streams (Davenport & Harris, 2017).

Scenario 4: Traditional Resilience

In this scenario, sports enterprises remain cautious about integrating AI into their core operations despite the potential benefits, preferring conventional strategies. AI applications are often limited to straightforward functions like monitoring athlete performance or managing ticket purchases. At the same time, the primary sources of revenue are still tied to broadcasting deals and tangible products. Fan interaction largely adheres to established practices, emphasizing in-person attendance and physical ticket transactions over digital experiences. Environmental sustainability efforts are lacking, as sports entities prioritize preserving their current business models over exploring AI-integrated solutions or eco-friendly alternatives, hindering the industry's ability to evolve and expand (Dignum, 2018).

5. Discussion

In the context of sports businesses, various vital issues contribute to shaping the future as projected by AI-driven scenarios. These issues include (1) technology and AI integration, (2) consumer behavior shifts, (3) sustainability concerns, and (4) governance and financial strategies. Each of these areas forms the foundation for analyzing the future directions and challenges that will determine the success of sports organizations by 2030.

Technological disruption and the integration of AI have become crucial in transforming the landscape of sports management. In Scenario 1 ("AI-Powered Innovation"), the total adoption of AI across all facets of sports organizations dramatically reshapes operations. Cutting-edge artificial intelligence technologies like GPT-4 are employed to bolster performance analysis, empowering sports organizations to forecast match results, streamline training regimens, and curate tailored fan engagement experiences. AI-driven adaptive pricing strategies and personalized product suggestions revolutionize how enthusiasts engage with sports franchises and brands (Christensen, Raynor, & McDonald, 2015).

In addition to operational improvements, AI also influences strategic decision-making by analyzing large volumes of data to provide insights into market trends, revenue models, and sponsorship opportunities. Diversifying revenue sources and fostering robust business strategies have become crucial for organizations aiming to thrive in the highly competitive sports industry.

However, as seen in Scenario 4 ("Traditional Resilience"), embracing AI technologies could be crucial for driving progress. Conventional entities heavily dependent on traditional revenue streams like broadcasting rights and merchandising might face challenges in keeping up with the fast-paced transformations shaping their landscape (Dignum, 2018).

Understanding and adapting to changes in consumer behavior is another critical issue. Scenario 3 ("Consumer-Centric Tech") focuses on how sports organizations will cater to tech-savvy fans who demand personalized experiences. AI systems like BERT are utilized to study fan preferences, enabling organizations to provide customized offerings, such as immersive virtual reality experiences or in-game wagering

opportunities. This approach resonates with research emphasizing the escalating significance of digital engagement and fan-centric experiences as revenue streams for sports enterprises (Davenport & Harris, 2017).

To maintain fan loyalty and captivate audiences, sports entities must adapt by embracing cutting-edge tactics. As younger generations gravitate towards emerging technologies, organizations must implement creative approaches to attract and retain spectators. This could involve offering digital content, immersive encounters, or direct social media interactions.

Scenario 2 emphasizes the growing importance of sustainability, driven by regulatory requirements and consumer expectations. By adopting AI-driven energy management systems, sports organizations can align with eco-friendly practices while addressing operational challenges (Fadli et al., 2024). With increasing pressure from fans and regulators, sports businesses must adopt sustainability measures, such as carbon-neutral stadiums and eco-friendly merchandise. Sports organizations can make a smart move in markets with tight environmental regulations by embracing AI technology. It's not just about going green; it's a powerful way to boost their eco-friendly reputation and appeal to fans who care deeply about the planet. AI integration in sustainability efforts can be a win-win for both environmental impact and brand popularity.

However, in Scenario 4, environmental initiatives are underdeveloped, which may result in missed opportunities to appeal to the growing demand for sustainable practices. Studies have shown that businesses that fail to incorporate sustainability into their operations risk alienating a significant portion of their fan base, particularly in regions where green practices are becoming the norm (Bettley & Burnley, 2008).

Robust governance and adherence to regulatory frameworks are pivotal for the enduring prosperity of sports enterprises. Scenario 2 envisions a future where stringent environmental regulations and AI governance protocols are indispensable for sustaining competitive edges. Sports organizations must comply with stringent data privacy laws and digital rights management, particularly as they increasingly incorporate AI-driven systems. Effective governance mechanisms ensure that AI technologies are utilized ethically and responsibly, shielding the organization and its stakeholders from legal and financial vulnerabilities (Li, 2024).

On the financial side, AI-driven business models transform how organizations generate revenue. In Scenario 1, AI plays a central role in developing new revenue streams, such as blockchain-based ownership models and non-fungible tokens (NFTs), which enable fans to purchase unique digital assets associated with their favorite teams or players. This shift toward digital revenue models is becoming increasingly important as traditional sponsorship and broadcasting revenues face disruption from technological advances (Christensen, Raynor, & McDonald, 2015).

Collaborative ventures involving public and private entities, exemplified in Scenario 2, play a pivotal role in securing funding for large-scale infrastructure undertakings, such as constructing energy-efficient sports venues. This synergistic approach between governmental bodies and private investors enables sports

organizations to tap into the necessary resources for developing cutting-edge facilities that comply with regulatory mandates and cater to consumer preferences for sustainable practices (VU, 2019).

In Scenario 1, AI takes center stage in sports management, offering a new game plan. With tools like GPT-4 and BERT, teams can make smarter decisions, coach players to peak performance, and give fans an unforgettable experience. Imagine AI predicting the perfect training routine or suggesting the must-have merch right when the excitement peaks! This means team bosses can work with solid data, and sponsors can hit the right target every time. Conversely, Scenario 2 highlights eco-friendliness, using AI to tackle energy waste and carbon footprints in sports venues. AI helps teams follow green rules and meet fan expectations, like switching to renewable energy and creating eco-conscious stadiums. It's a win for both the planet and the sports brand, keeping fans and officials happy while contributing to a healthier world.

Scenarios 3 (Consumer-Centric Tech) and 4 (Traditional Resilience) illustrate divergent trajectories shaped by varying levels of AI adoption and stakeholder engagement. Scenario 3 emphasizes the demand for immersive, tech-driven experiences, exemplified using augmented reality (AR) in live sports events, allowing fans to engage interactively with games from remote locations. Stakeholders such as fan-focused marketers benefit from these developments by creating deeper connections with audiences, while organizations diversify revenue through innovative models like in-game betting and virtual event passes. In contrast, Scenario 4 reflects a conservative approach where traditional practices dominate, and AI applications are restricted to basic tasks such as ticketing or logistical management. While this approach appeals to traditionalists, it risks alienating younger, tech-oriented audiences and failing to capitalize on sustainability initiatives. Stakeholders like policymakers and environmental advocates may also critique such organizations for neglecting eco-friendly practices, which are increasingly considered essential in the modern sports industry.

6. Conclusion

Integrating artificial intelligence (AI) technologies in sports is on the verge of creating a fundamental transformation in the industry, offering innovative solutions for fan engagement, financial management, and operational performance improvement. However, this transformative path comes with complex challenges such as ethical considerations, data management, and balancing technology acceptance and traditional methods. This research indicates that artificial intelligence can enhance decision-making processes, personalize fan experiences, and create new revenue streams. Still, sports organizations must carefully address the associated complexities. AI models will play a key role in shaping the future of sports, but their impact will depend on the extent of acceptance of change by industry stakeholders.

Scenario planning is recognized as a valuable tool in predicting the future of sports, especially in analyzing how various factors interact, such as technological advancements, fan behavior, and environmental concerns, in shaping the industry’s path. Developing four distinct scenarios - AI-based innovation, sustainability focus,

consumer technology-centric, and traditional flexibility - provides different perspectives on the future of this industry. Each scenario offers insights into the evolution of AI technologies, sustainability innovations, and fan preferences, and offers strategic pathways for organizations to prepare for an uncertain future. This approach allows stakeholders to anticipate challenges and opportunities and be prepared for informed and proactive decision-making.

While this research provides a comprehensive examination of the future of sports, it must also consider numerous limitations. The qualitative nature of the scenarios provides a space for further research on the quantitative implications of artificial intelligence and other driving forces in the industry. Additionally, while this research emphasizes the importance of stakeholder participation in shaping the future, it does not provide a detailed roadmap for how various actors - such as leagues, teams, and regulatory bodies - can participate in realizing these scenarios. This research emphasizes the qualitative nature of its scenarios and opens space for future research on determining the quantitative impacts of artificial intelligence and more active stakeholder participation in implementing these perspectives. Future studies can use modeling and simulation techniques to determassessine the potential outcomes of each scenario quantitatively, based on this research, providing a data-driven approach to strategic foresight.

Disclosure statement

The researchers declare that they have no conflicting interests related to this investigation. Furthermore, no financial support or funding was received from any organization or entity for the execution of this study.

Acknowledgment

Nous tenons à exprimer notre profonde reconnaissance envers toutes les personnes qui ont pris part à cette étude.

References

Barker, D., & Smith, D. J. H. (1995). Technology foresight using roadmaps. *Long Range Planning*, *28*(2), 21-28. https://doi.org/10.1016/0024-6301(95)98586-H

Battistella, C., & De Toni, A. (2012). *Exploring the organizational design for resilience and foresight*. SSRN. https://doi.org/10.2139/ssrn.2129588

Bettley, A., & Burnley, S. (2008). Towards sustainable operations management integrating sustainability management into operations management strategies and practices. *Handbook of performability engineering*, 875-904. https://doi.org/10.1007/978-1-84800-131-2_73

Boldt, J., & Orrù, E. (2022). Towards a unified list of ethical principles for emerging technologies. An analysis of four European reports on molecular biotechnology and artificial intelligence. *Sustainable Futures*, *4*, 100086. https://doi.org/10.1016/j.sftr.2022.100086

Bonab, S. A., & Yazdani-Asrami, M. (2025). Artificial intelligence-based model to predict the heat transfer coefficient in flow boiling of liquid hydrogen as fuel and cryogenic

coolant in future hydrogen-powered cryo-electric aviation. *Fuel*, *381*, 133323. https://doi.org/10.1016/j.fuel.2024.133323

Bonsu, N. O., Dhubháin, Á. N., & O'Connor, D. (2017). Evaluating the use of an integrated forest land-use planning approach in addressing forest ecosystem services conflicting demands: Experience within an Irish forest landscape. *Futures*, *86*, 1-17. https://doi.org/10.1016/j.futures.2016.08.001

Butterworth, M. (2018). The ICO and artificial intelligence: The role of fairness in the GDPR framework. *Computer Law & Security Review*, *34*(2), 257-268. https://doi.org/10.1016/j.clsr.2018.01.004

Chan, L., Hogaboam, L., & Cao, R. (2022). Artificial Intelligence in Sports. In *Applied Artificial Intelligence in Business: Concepts and Cases* (pp. 353-361). Springer. https://doi.org/10.1007/978-3-030-97496-1_20

Christensen, C. M., Raynor, M., & McDonald, R. (2015). Disruptive innovation. *Harvard Business Review*, *93*(12), 44-53. https://doi.org/10.1016/0737-6782(96)81091-5

Cury, R., Kennelly, M., & Howes, M. (2023). Environmental sustainability in sport: A systematic literature review. *European Sport Management Quarterly*, *23*(1), 13-37. https://doi.org/10.1080/16184742.2023.2134509

Davenport, T., & Harris, J. (2017). *Competing on analytics: Updated, with a new introduction: The new science of winning*. Harvard Business Press. https://doi.org/10.1145/2897824.2925955

De Haro, S. (2020). Science and philosophy: A love–hate relationship. *Foundations of Science*, *25*(2), 297-314.

Dignum, V. (2018). Ethics in artificial intelligence: introduction to the special issue. *Ethics and Information Technology*, *20*(1), 1-3. https://doi.org/10.1007/s10676-018-9449-3

Dupuit, M., Meignié, A., Chassard, T., Blanquet, L., LeHeran, J., Delaunay, T., Bernardeau, E., Toussaint, J.-F., Duclos, M., & Antero, J. (2023). On-field methodological approach to monitor the menstrual cycle and hormonal phases in elite female athletes. *International Journal of Sports Physiology and Performance*, *1*(aop), 1-10. https://doi.org/10.1123/ijspp.2023-0087

Fadli, F., Himeur, Y., Elnour, M., & Amira, A. (2024). Unveiling Hidden Energy Anomalies: Harnessing Deep Learning to Optimize Energy Management in Sports Facilities. *arXiv preprint arXiv:2402.08742*. https://doi.org/10.48550/arXiv.2402.08742

Ferrucci, D., Brown, E., Chu-Carroll, J., Fan, J., Gondek, D., Kalyanpur, A. A., Lally, A., Murdock, J. W., Nyberg, E., & Prager, J. (2010). Building Watson: An overview of the DeepQA project. *AI magazine*, *31*(3), 59-79. https://doi.org/10.1609/aimag.v31i3.2303

Geissler, D., Beiderbeck, D., Schmidt, S. L., & Schreyer, D. (2024). Emerging technologies and shifting consumer motives: Projecting the future of the top-tier sports media product. *Technological Forecasting and Social Change*, *203*, 123366. https://doi.org/10.1016/j.techfore.2023.123366

Giannessi, E. (1958). *Il "Kreislauf" tra costi e prezzi come elemento determinante delle condizioni di equilibrio del sistema d'azienda* [1130291776117656611]. Colombo Cursi. https://doi.org/10.3280/qua2021-113010

Graham, J. R., & Rogers, D. A. (2002). Do firms hedge in response to tax incentives? *The Journal of finance*, *57*(2), 815-839. https://doi.org/10.1111/1540-6261.00441

Grzybowski, A., Pawlikowska–Łagód, K., & Lambert, W. C. (2024). A history of artificial intelligence. *Clinics in Dermatology*, *42*(3), 221-229. https://doi.org/10.1016/j.clindermatol.2023.12.001

Guilherme, A. (2019). AI and education: the importance of teacher and student relations. *AI & society*, *34*, 47-54. https://doi.org/10.1007/s00146-017-0735-3

Guo, Q., & Li, B. (2021). Role of AI physical education based on application of functional sports training. *Journal of Intelligent & Fuzzy Systems*, *40*(2), 3337-3345. https://doi.org/10.3233/JIFS-189157

Haghparast, M., Soltan Hoseini, M., & Nasr Esfahani, D. (2024). A Financial Management Maturity Model in Sports Organizations: A Novel Approach Using Artificial Intelligence. *Journal of New Studies in Sport Management*, -. https://doi.org/10.22103/jnssm.2024.24171.1335

Henri, J.-F. (2016). Henri, JF, Boiral, O., & Roy, MJ (2016). Strategic cost management and performance: The case of environmental costs. The British Accounting Review, 48 (2), 269-282. https://doi.org/10.1016/j.bar.2015.01.001

Hertzel, M. G., & Officer, M. S. (2012). Industry contagion in loan spreads. *Journal of Financial Economics*, *103*(3), 493-506. https://doi.org/10.1016/j.jfineco.2011.09.007

Hinojosa, A. M. O., MacLeod, K. E., Balmes, J., & Jerrett, M. (2018). Influence of school environments on childhood obesity in California. *Environmental research*, *166*, 100-107. https://doi.org/10.1016/j.envres.2018.05.009

Ho, K. L. P., Nguyen, C. N., Adhikari, R., Miles, M. P., & Bonney, L. (2018). Exploring market orientation, innovation, and financial performance in agricultural value chains in emerging economies. *Journal of Innovation & Knowledge*, *3*(3), 154-163. https://doi.org/10.1016/j.jik.2017.03.008

Hong, C., & Ren, J. (2022). [Retracted] Research on the Implementation of Public Physical Education under the Network Environment. *Applied Bionics and Biomechanics*, *2022*(1), 6391614. https://doi.org/10.1155/2022/6391614

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288. https://doi.org/10.1177/1049732305276687

Huang, X., Huang, X., & Wang, X. (2021). [Retracted] Construction of the Teaching Quality Monitoring System of Physical Education Courses in Colleges and Universities Based on the Construction of Smart Campus with Artificial Intelligence. *Mathematical Problems in Engineering*, *2021*(1), 9907531. https://doi.org/10.1155/2021/9907531

Jadhav, H. B., Alaskar, K., Desai, V., Sane, A., Chaudhary, P., Annapure, U., Uddin, J., & Nayik, G. A. (2024). Transformative impact: Artificial intelligence in the evolving landscape of processed food-a concise review focusing on some food processing sectors. *Food Control*, 110803. https://doi.org/10.1016/j.foodcont.2023.110803

Kassi, D. F., Rathnayake, D. N., Louembe, P. A., & Ding, N. (2019). Market risk and financial performance of non-financial companies listed on the Moroccan stock exchange. *Risks*, *7*(1), 20. https://doi.org/10.3390/risks7010020

Katz, A., Shakir, U., & Chambers, B. (2023). The utility of large language models and generative AI for education research. *arXiv preprint arXiv:2305.18125*. https://doi.org/10.48550/arXiv.2305.18125

Kennerley, M., & Neely, A. (2002). A framework of the factors affecting the evolution of performance measurement systems. *International journal of operations & production management*, *22*(11), 1222-1245. https://doi.org/10.1108/01443570210450293

Kharchenko, T., & Ziming, L. (2021). The Relationship between Sports Industry Development and Economic Growth in China. *Accounting & Finance/Oblik i Finansi*, *1*(91), 36-140. https://doi.org/10.33146/2307-9878

Leitner, K.-H. (2020). Corporate Foresight. In *Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship* (pp. 366-373). Springer. https://doi.org/10.1007/978-3-319-15347-6_416

Li, Z. (2024). Ethical frontiers in artificial intelligence: navigating the complexities of bias, privacy, and accountability. *International Journal of Engineering and Management Research*, *14*(3), 109-116. https://doi.org/10.31033/ijemr.14.3.18

Liu, Y., Ludie, Guo., Ping, Kuang., Fan, Zhou. (2024). Biases Mitigation and Expressiveness Preservation in Language Models: A Comprehensive Pipeline. *Student Abstract*, *2*, 1-20. https://doi.org/10.1609/aaai.v38i21.30532

Lu, L., Yang, S., & Li, Q. (2024). The interaction of digital economy, artificial intelligence and sports industry development--based on China PVAR analysis of provincial panel data. *Heliyon*, *10*(4). https://doi.org/10.1016/j.heliyon.2024.e15074

Mukhtar, H. (2025). Artificial intelligence techniques for human-machine interaction. In *Artificial Intelligence and Multimodal Signal Processing in Human-Machine Interaction* (pp. 19-42). Elsevier. https://doi.org/10.1016/B978-0-323-90463-9.00002-1

Naughton, M., Salmon, P. M., Compton, H. R., & McLean, S. (2024). Challenges and opportunities of artificial intelligence implementation within sports science and sports medicine teams. *Frontiers in Sports and Active Living*, *6*, 1332427. https://doi.org/10.3389/fspor.2024.1332427

Nielsen, S. B., Sarasoja, A.-L., & Galamba, K. R. (2016). Sustainability in facilities management: an overview of current research. *Facilities*, *34*(9/10), 535-563. https://doi.org/10.1108/F-01-2015-0006

Okasha, S. (2016). *Philosophy of science: very short introduction*. Oxford University Press.

Radford, A. (2018). Improving language understanding by generative pre-training. *Artificial intelligence system approaching neuroradiologist-level differential diagnosis accuracy at brain MRI. Radiology*, 626–637. https://doi.org/10.1148/radiol.2020192247

Rauschecker, A. M., Rudie, J. D., Xie, L., Wang, J., Duong, M. T., Botzolakis, E. J., Kovalovich, A. M., Egan, J., Cook, T. C., & Bryan, R. N. (2020). Artificial intelligence system approaching neuroradiologist-level differential diagnosis accuracy at brain MRI. *Radiology*, *295*(3), 626-637. https://doi.org/10.1148/radiol.2020192247

Rohrbeck, R., & Gemünden, H. G. (2011). Corporate foresight: Its three roles in enhancing the innovation capacity of a firm. *Technological Forecasting and Social Change*, *78*(2), 231-243. https://doi.org/10.2196/54704

Sossa, J. W. Z., Posada, N. G., Montoya, L. H. B., Monsalve, A. M. Z., Piedrahíta, J. C. P., Mendoza, G. L. O., Grisales, L. V., & Cano, L. F. G. (2024). Foresight study using scenarios and the Delphi method in the leather agroindustrial chain to 2035-Alignment of results with open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(3), 100374. https://doi.org/10.3390/joitmc10030074

Sunitiyoso, Y., Wicaksono, A., Pambudi, N. F., Rahayu, W. A., Nurdayat, I. F., Hadiansyah, F., Nuraeni, S., & Muhammad, A. A. (2023). Future of mobility in Jakarta Metropolitan Area: A Multi-Stakeholder scenario planning. *Transportation Research Interdisciplinary Perspectives*, *19*, 100810. https://doi.org/10.1016/j.trip.2023.100810

Thomas, J. (2025). Artificial intelligence and public health: challenges and opportunities. *Digital Technology in Public Health and Rehabilitation Care*, 353-361. https://doi.org/10.1016/j.futures.2019.102513

Vinyals, O., Babuschkin, I., Czarnecki, W. M., Mathieu, M., Dudzik, A., Chung, J., Choi, D. H., Powell, R., Ewalds, T., & Georgiev, P. (2019). Grandmaster level in StarCraft II using multi-agent reinforcement learning. *nature*, *575*(7782), 350-354. https://doi.org/10.1038/s41586-019-1724-z

VU, H. M. (2019). A decision-making framework to select a public-private partnership scheme for infrastructure development in Vietnam. *The Russian Academy of Sciences*, 25-40. https://doi.org/10.31857/s020736760004412-2

Wang, Y., Fu, E. Y., Zhai, X., Yang, C., & Pei, F. (2024). Introduction of artificial Intelligence. In *Intelligent Building Fire Safety and Smart Firefighting* (pp. 65-97). Springer. https://doi.org/10.1007/978-3-031-35879-1_4

Wilkinson, A., & Kupers, R. (2013). Living in the futures. *Harvard Business Review*, *91*(5), 118-127. https://doi.org/2010-2019/2013/518

Yan, L., Sha, L., Zhao, L., Li, Y., Martinez-Maldonado, R., Chen, G., Li, X., Jin, Y., & Gašević, D. (2024). Practical and ethical challenges of large language models in education: A systematic scoping review. *British Journal of Educational Technology*, *55*(1), 90-112. https://doi.org/10.1111/bjet.13322

Zhang, Y., Li, X., Zheng, J., Kang, J., & Cai, G. (2025). Research on interactive sports game experience in physical training system based on digital entertainment technology and sensor devices. *Entertainment Computing*, *52*, 100866. https://doi.org/10.1016/j.entcom.2024.100866

Zhu, D., Chen, J., Shen, X., Li, X., & Elhoseiny, M. (2023). Minigpt-4: Enhancing vision-language understanding with advanced large language models. *arXiv preprint arXiv:2304.10592*. https://doi.org/10.48550/arXiv.2304.10592