Scientific Research Publishing

Open Journal of Business and Management, 2023, 11, 1454-1478
https://www.scirp.org/journal/ojbm
ISSN Online: 2329-3292
ISSN Print: 2329-3284

Artificial Intelligence (AI) in the Management of Inter-Municipal Tourism Consortia

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How to cite this paper: Zancan, C., Passador, J. L., & Passador, C. S. (2023). Artificial Intelligence (AI) in the Management of Inter-Municipal Tourism Consortia. *Open Journal of Business and Management, 11,* 1454-1478.
https://doi.org/10.4236/ojbm.2023.114080

Received: May 26, 2023
Accepted: July 9, 2023
Published: July 12, 2023

Abstract

The main objective of this article is to analyze how the application of artificial intelligence (AI) contributes to the integrated management of inter-municipal tourism consortia, enabling better planning, decision-making, and project execution in tourism municipal departments. Integrated management of inter-municipal tourism consortia is a relevant issue as it allows for coordinated actions aimed at promoting regional tourism in a sustainable manner. To achieve this objective, bibliographic reviews and analysis of the characteristics of existing consortia in this segment were carried out, providing qualitative and descriptive aspects to the study. The results indicate that AI can be applied in various stages of managing these consortia, from identifying opportunities to evaluating results, including data analysis and demand forecasting. It was concluded that the application of AI can be an important strategy to improve the management of these consortia and contribute to the sustainable development of the sector. Suggestions for future studies include conducting empirical research to assess the impact of integrated AI models on the management of inter-municipal tourism consortia. Additionally, it is important to explore how emerging technologies such as the Internet of Things (IoT) and Virtual Reality (VR) can be integrated with AI to further enhance the integrated management of these consortia.

Keywords

Artificial Intelligence, Management, Inter-Municipal Consortia, Tourism, Brazil

1. Introduction

The tourism industry plays an increasingly important role in the global econo-

my, encompassing a wide range of activities such as accommodation, transportation, catering, entertainment and recreation. It is a major source of employment worldwide. Consequently, tourism has a significant impact on local economies by attracting investment and generating income for host communities. In recent years, the tourism industry has evolved rapidly due to technological advances and the growing demand for personalized and authentic experiences. In addition, the COVID-19 pandemic has had a profound impact on the industry, requiring adjustments and the introduction of security measures to protect travelers.

Therefore, it is essential for the tourism industry to constantly evolve and adapt to market changes in order to maintain growth and contribute to the economic and social development of tourism regions. In Brazil, the coordination of inter-municipal tourism consortia is an important issue for municipal leaders. These consortia facilitate integrated actions between municipalities to promote sustainable regional tourism. These collaborations can create partnerships between municipal governments, tourism businesses, and other local organizations that facilitate the development of joint projects to improve infrastructure, promote destinations, train professionals, and create new tourism-tailored products and services.

However, integrated management is fraught with challenges due to the complex relationships among participating communities. Each municipality may have different priorities and interests, leading to conflicts and decision-making difficulties. In addition, the establishment of an inter-municipal consortium requires a high degree of cooperation and coordination, which can be difficult to achieve in certain situations. Therefore, it is critical to understand the obstacles encountered in the integrated management of inter-municipal tourism consortia so that effective strategies can be developed to overcome these obstacles and ensure successful management.

Artificial intelligence (AI) can be a valuable strategy for improving the integrated management of consortia by enabling better planning, decision-making, and project execution. AI can be used at various stages of consortium management, such as opportunity identification, data analysis, demand forecasting, and outcome assessment. By using techniques such as data analytics and tourism demand forecasting, AI can provide consortium managers with accurate information in real time, enabling informed decision making.

Recent research has demonstrated that the implementation of artificial intelligence (AI) can yield significant advantages for the integrated management of inter-municipal tourism consortia, as highlighted by Brink, Richards, and Van Niekerk (2020), Martins et al. (2019), and Radojevic and Stanic (2019). One prominent benefit is the capability to analyze vast volumes of data in real-time, enabling faster and more precise decision-making. AI enables the examination of tourist behavior data, the identification of patterns and trends, and the prediction of future demand. This information assists in planning promotional campaigns and tourism development initiatives within the consortium's com-

munities. Furthermore, AI facilitates the establishment of an integrated information system among participating municipalities, enhancing information sharing and the coordination of collaborative activities.

In addition, AI can contribute to integrated management through predictive modeling. AI enables the creation of models that predict tourist behavior, such as preferred activities, length of stay, and tourist profiles. These models enable consortium managers to make informed decisions and improve tourism project planning and execution. AI can also help identify business opportunities and develop personalized marketing strategies tailored to different tourist profiles. This can maximize the region's tourism potential and increase the competitiveness of destinations within the consortium.

Therefore, the objective of this study is to analyze the application of AI in the integrated management of inter-municipal tourism consortia. Tourism is an important industry in many regions around the world, driving local growth and development. Inter-municipal tourism consortia in Brazil offer an interesting approach to the integrated management of destinations by involving several municipalities in joint actions to promote and develop services that can be shared among the different stakeholders of the consortium.

The application of artificial intelligence (AI) offers the opportunity to improve the management of these consortia by analyzing Big Data, identifying patterns and trends, and predicting demand and tourist behavior. By exploring how AI can contribute to the integrated management of inter-municipal tourism consortia, this study can provide insights for adopting more effective public policies and improving destination competitiveness.

This article is organized as follows: After this introduction, a conceptual overview of inter-municipal consortia and aspects of their management is provided. It then discusses the potential uses of artificial intelligence models for the integrated management of these consortia, particularly for tourism activities. The study then describes the procedures and methods used. Then, the results of the application of artificial intelligence for the integrated management of inter-municipal tourism consortia are presented. Finally, the conclusions and references to this study are given.

2. Theoretical Background

Integrated management of inter-municipal tourism consortia is an important strategy for regional tourism development. The application of artificial intelligence (AI) can bring significant benefits in this context, such as improved decision making, higher efficiency, and cost reduction. This theoretical framework presents studies that discuss the application of AI in the integrated management of inter-municipal tourism consortia.

2.1. Inter-Municipal Tourism Consortia

Inter-municipal tourism consortia are cooperative associations created with the

aim of promoting regional tourism development and fostering cooperation among the various stakeholders in the sector. This cooperative approach has been shown to be very effective in promoting sustainable tourism practices by enabling coordinated action. By working together, communities can pool resources and knowledge, improve the efficiency of planning and project implementation, and strategically promote tourism in an integrated manner (Ferreira & Pereira, 2016).

According to Vieira and Antonini (2014), inter-municipal tourism consortia facilitate the formation of a strong regional identity and the implementation of integrated initiatives, promoting the diversification of tourism supply and securing resources for the sector. These consortia also promote the exchange of knowledge and resources, improving the efficiency of project management and implementation. The authors emphasize that the commitment of participating municipalities and effective coordination among the various tourism stakeholders are essential to the success of inter-municipal tourism consortia. In addition, it is crucial to prioritize sustainable tourism practices and the preservation of the region's cultural and natural resources.

The management of inter-municipal tourism consortia requires the coordination of various activities, including tourism promotion, event management, and tourism infrastructure development. These joint efforts of member municipalities are aimed at integrated and sustainable tourism development. Tourism promotion includes the dissemination of information about tourist attractions through social media, guidebooks, blogs, special websites, and the organization of thematic events. Event management includes planning special programs such as festivals, exhibitions, and cultural activities to attract visitors and showcase local culture. Finally, tourism infrastructure includes essential services such as accommodation, transportation, catering, and tourist support, which require careful planning and management to ensure visitor satisfaction and comfort.

Ferreira and Pereira (2016) emphasize the importance of tourism promotion for the success of inter-municipal tourism consortia. Effective communication strategies, such as the use of social media, guidebooks, blogs, specialized websites, and the organization of thematic events, are crucial for promoting the region's tourist attractions to potential visitors. The authors also emphasize the importance of event management in attracting visitors and stimulating local economic growth. By jointly planning special programs, festivals, exhibitions, and cultural activities, member municipalities can attract a significant number of tourists and effectively promote local culture (Ferreira & Vieira, 2016).

The main objective of inter-municipal tourism consortia is to promote regional tourism development through cooperation among member municipalities. Consortia facilitate the offering of comprehensive tourism packages that include multiple cities and tourist attractions within the region. This integrated approach increases the appeal to visitors and extends their stay, contributing to local economic and social development. In addition, this strategy promotes a

more equitable distribution of tourism benefits by showcasing lesser-known communities and highlighting the region's cultural and environmental diversity.

Nogarotto and Marques (2019) emphasize the importance of inter-municipal tourism consortia in promoting regional tourism development through collaboration among member municipalities. By integrating tourist attractions and cities within the region, consortia can offer comprehensive tour packages that attract visitors and prolong their stay. The authors also emphasize that consortia contribute to local economic and social development while promoting a more equitable distribution of tourism benefits, thereby enhancing the region's cultural and environmental diversity.

However, inter-municipal tourism consortia are not only concerned with promoting regional tourism, but also have significant socioeconomic impacts on member municipalities. Cooperation between municipalities enables the sharing of resources and knowledge, which leads to job creation, increased income, and improved tourism infrastructure and services. This association of municipalities with common goals strengthens the local economy and facilitates the implementation of public policies aimed at sustainable regional development.

de Almeida and Viegas (2016) argue that the establishment of inter-municipal tourism consortia in Brazil has proven to be an effective strategy to promote the socioeconomic development of member municipalities. Collaboration between municipalities allows the sharing of resources and knowledge, leading to job creation, income generation, and improvement of tourism infrastructure and services. The authors also emphasize that this cooperative approach strengthens the local economy and enables the implementation of public policies for sustainable regional development. They argue that inter-municipal tourism consortia can serve as important tools for regional tourism planning and management by integrating different stakeholders in the tourism production chain and valuing the cultural, historical and natural heritage of the region.

Finally, inter-municipal tourism consortia offer a promising path for sustainable development of the sector, as cooperation among member municipalities allows for the creation of comprehensive and integrated tourism offerings that generate jobs and income and improve local infrastructure. However, the management of these associations is a complex task that requires the coordination of different activities, the promotion of sustainable practices and the formulation of strategic plans for regional tourism development.

In this context, the application of artificial intelligence (AI) represents a potential solution to improve the integrated management of inter-municipal tourism consortia. AI technologies and tools can help coordinate activities and develop strategic plans that take into account the unique characteristics and potential of each community. In addition, AI can help promote sustainable tourism practices throughout the production chain, taking into account environmental considerations and the well-being of local communities. Effective management of inter-municipal tourism consortia supported by artificial intelligence is

therefore critical to maximizing the benefits generated by tourism in the region, including socio-economic development and environmental protection.

2.2. Management of Inter-Municipal Tourism Consortia

Local government is the process of planning, organizing, directing, and controlling the activities and resources of a local public administration with the goal of meeting the needs and demands of the local population (Calmon & Costa, 2013). It includes various areas such as health, education, transportation, public safety, environment, urban planning, culture, and recreation. Local government is responsible for defining and implementing public policies to improve the quality of life of the population, and for managing and allocating resources in an efficient and transparent manner. Efficient municipal management is critical to ensuring sustainable development and the well-being of the local community.

On the other hand, managing an inter-municipal consortium means coordinating and managing joint actions between municipalities with the aim of solving common problems and promoting regional development in a cooperative manner. This includes everything from defining the requirements and objectives of the consortium, to managing financial and human resources, to implementing and evaluating the actions carried out. The consortium manager is responsible for leading discussions among the member municipalities, planning and implementing projects jointly, and ensuring the transparency and effectiveness of the actions carried out. Therefore, according to Vaz (1997), it is important that the consortium manager has negotiation skills, leadership, conflict management, and technical knowledge of the consortium's areas of activity.

There are different models for the management of inter-municipal consortia, which may vary according to the legislation of each country or region. All of these models are important because they allow municipalities with limited resources to collaborate and share services, infrastructure, and resources to achieve efficiency, effectiveness, and cost-effectiveness of public policies. In this way, the management of inter-municipal consortia helps to improve the quality of life of the population, as municipalities can join forces to address common problems and develop projects of common interest, such as the construction of landfills, solid waste management, the provision of health services, the formation of consortia for the purchase of medicines and the provision of public transport services, and more.

In addition, the management of inter-municipal consortia can bring financial benefits to municipalities, as cooperation and sharing of services and resources can reduce costs and waste, allowing for more efficient use of available resources. Therefore, inter-municipal consortium management mechanisms are important public management tools that can help promote sustainable development and the well-being of the population. Some common models for inter-municipal consortium management may include the aspects listed below (**Table 1**).

Table 1. Models of inter-municipal consortium management.

Model	Description
Full management	Municipalities transfer the responsibility for providing a specific service to the consortium, in its entirety or in part. The consortium assumes the management of the service, being responsible for hiring personnel, and acquiring equipment and supplies, among other activities. Full management in an inter-municipal consortium occurs when the participating municipalities fully transfer the management of a specific area to the consortium. An example of this is the full management of healthcare, where the participating municipalities delegate to the consortium the responsibility for managing and delivering healthcare services within their territory. In this management model, the consortium gains autonomy to manage the resources and services of the respective area, hire professionals, make investments, and define specific public policies for that area. As a result, the participating municipalities can ensure the provision of quality and efficient public services to the population.
Shared management	Shared management in an inter-municipal consortium occurs when the participating municipalities decide to share responsibilities and resources for the implementation of specific public policies. An example of this is the shared management of solid waste, where municipalities come together to jointly manage the treatment and disposal of waste produced in their cities. In this case, each municipality may be responsible for collecting the waste within its territory and transporting it to the treatment facility, while the inter-municipal consortium is responsible for managing the operation and maintenance of the landfill or other chosen treatment methods. This arrangement allows for a division of tasks and resources between the municipalities and the consortium, leading to service optimization.
Associated management	The municipalities participating in the consortium maintain their autonomy but associate themselves to jointly provide services, sharing responsibilities, and financial resources. An example of associated management in an inter-municipal consortium could be the cooperation between municipalities to construct and administer a shared landfill. In this case, the municipalities come together in a consortium to divide the costs of construction and maintenance of the landfill, which will be used by all the participating municipalities. The inter-municipal consortium will be responsible for managing the landfill, including overseeing compliance with environmental regulations, waste management, and contracting specialized companies for operation and maintenance services, among other activities. In this case, associated management allows municipalities to share resources and expertise to achieve a common and more efficient solution for waste treatment.
Integrated management	In this model, municipalities and other entities involved in service provision work together in an integrated manner, sharing information and financial resources to promote efficient service management. Integrated management involves the collaboration of different areas of operation of participating municipalities to make joint decisions toward a common objective. An example could be the establishment of an inter-municipal consortium focused on the economic development of a region. In this situation, the participating municipalities could join forces to attract investments to the region, promote local tourism, and create agricultural incentive projects, among other initiatives that contribute to the integrated and coordinated development of the area. In this management model, decision-making is shared between municipalities, and actions are planned and executed collectively, aiming for the benefit of all involved parties.

Source: adapted by Oliveira and Alves (2018).

It is important to highlight that each management model may present specific characteristics, advantages, and disadvantages depending on its applied context. The choice of the appropriate model should take into consideration the region's characteristics, the type of service to be provided, and the current legislation, among other relevant factors. The characteristics of each inter-municipal consortium management model are based on the cooperation among participating municipalities, united by common objectives. Therefore, the management of an inter-municipal consortium also involves the decentralization of resources and

power, granting participating municipalities autonomy to manage their local policies. Additionally, the participating municipalities share resources, services, and knowledge, aiming to obtain advantages they would not achieve individually (Oliveira & Alves, 2018).

According to Leão et al. (2022), another characteristic of the inter-municipal consortium management model is the pursuit of efficiency in the provision of public services, optimizing resources, and improving service quality. Thus, efficiency gains prominence. Furthermore, the management of the inter-municipal consortium should be transparent and based on ethical principles to ensure the trust of the population and supervisory bodies; hence transparency is fundamental. Finally, the participating municipalities must actively participate in the management of the inter-municipal consortium so that the decisions made reflect the needs and interests of the local population—an important characteristic. Linked to active participation is the need for the inter-municipal consortium management model to be flexible and adaptable to changes in political, economic, and social conditions, to continue meeting the needs of the participating municipalities over time.

Likewise, the main advantages of an inter-municipal consortium management model include cost reduction, improved efficiency, expanded service delivery capacity, and resolution of challenges. It also strengthens the bargaining power, enhances service quality through resource and knowledge sharing, and improves management and regional integration, as the inter-municipal consortium can contribute to regional integration, fostering socioeconomic development and strengthening bonds among member municipalities (Flexa & Barbastefano, 2019).

Vaz (1997) and Flexa & Barbastefano (2019) also observe disadvantages in these management models, including administrative complexity: an inter-municipal consortium may involve multiple cities, each with its own demands and needs. This can make consortium administration more complex and challenging to manage; political disputes: political disputes among member cities can hinder the decision-making process and project implementation; financial difficulties: funding consortium projects can be a challenge, especially when member cities have limited financial resources. The cost-sharing can also be a point of conflict among members; operational difficulties: Consortium members may have different ways of operating and varying levels of skill and experience in project management. This can lead to delays and inefficiencies in project implementation and dependence on external resources: Depending on the adopted management model, the consortium may rely on external resources such as government funding or partnerships with private companies, which can affect its independence and flexibility in decision-making.

It is worth noting that these disadvantages can be managed and overcome through good consortium management and collaboration among involved members. One alternative found and verified in this article is the use of artificial intelligence, as this tool is helpful in overcoming challenges and making man-

agement more efficient and effective. Among the ways in which artificial intelligence can be used to improve the management of inter-municipal consortia is by enhancing communication among consortium members. For example, chat bots and virtual assistants can be implemented to address frequently asked questions and provide real-time updated information.

Furthermore, the coordination of activities and processes among consortium members can be employed, for instance, to determine the best waste collection routes in different municipalities and at different times, avoiding congestion and ensuring efficient coverage of all areas. Lastly, artificial intelligence can be used to provide insights and analyses that help guide joint decision-making. Data analytics algorithms, for instance, can be utilized to identify patterns and trends in different areas, assisting consortium members in making informed decisions on issues such as urban planning and waste management (Zhou, 2021; Walczak, 2019).

In summary, artificial intelligence can be utilized to improve communication, coordination, decision-making, and process standardization in the management models of inter-municipal consortia. By implementing these technologies, consortium member municipalities can work in a more coordinated and efficient manner, ensuring the long-term success of the consortium. For these reasons, the application of the concept of artificial intelligence is discussed in the next section to integrate the management of inter-municipal tourism consortia.

2.3. AI in the Integrated Management of Tourism Consortia

The integrated management of inter-municipal tourism consortia can greatly benefit from the application of artificial intelligence (AI). This emerging field of AI brings with it a series of advantages, such as improved efficiency in resource management, cost reduction, optimized planning, and more informed decision-making. Based on recent studies, there is a growing interest in this research area.

The study conducted by Nejati et al. (2021) investigated the application of AI in the management of smart tourist destinations, aiming to enhance the tourist experience and efficiency in managing tourism resources. The results revealed that AI plays a crucial role in personalizing the tourist experience through recommendations tailored to their individual preferences. Moreover, the use of AI allowed for more efficient resource management, contributing to the sustainability of tourist destinations. This study highlights the importance of AI as a promising tool to enhance tourism management, providing more personalized and efficient experiences while supporting the preservation and sustainable use of tourism resources.

The relevance of Nejati et al. (2021) study lies in the fact that the application of artificial intelligence in the management of smart tourist destinations has the potential to transform the tourism industry. Understanding how AI can improve the tourist experience and the efficiency in managing resources is crucial to

boosting the competitiveness of tourist destinations and promoting sustainable development. Personalization of the tourist experience through artificial intelligence not only meets individual needs and expectations, but also provides competitive advantages to destinations. The efficient management of tourism resources through AI contributes to environmental preservation, the conscious use of natural resources, and the promotion of sustainable practices in the industry.

The study conducted by Cai et al. (2020) presented an artificial intelligence model aimed at predicting tourist demand in specific regions. This model was developed using historical data and relevant socioeconomic variables. The results of the study demonstrated that the application of AI in predicting tourist demand can provide valuable insights for the integrated management of inter-municipal tourism consortia. The use of artificial intelligence in this context offers significant advantages for tourism industry planning and resource allocation. The ability to predict tourist demand allows managers to have a more accurate understanding of visitors' needs and preferences. Based on this information, they can make more well-informed decisions, ensuring a tourism offering that meets the demands of tourists.

By utilizing historical data and socioeconomic variables, the artificial intelligence model developed by the authors of the study is capable of capturing trends and patterns that can influence tourist demand. This enables more precise and reliable forecasting, allowing tourism managers to take proactive measures to meet future needs. The application of this model in the integrated management of inter-municipal tourism consortia brings additional benefits. Integrated management involves coordinating multiple regions to promote tourism collectively. By using artificial intelligence to predict tourist demand, inter-municipal consortia can optimize regional-scale planning and resource allocation, avoiding the uneven distribution of visitors.

Therefore, the results of the study by Cai et al. (2020) highlight the importance of applying artificial intelligence in forecasting tourism demand and how it can contribute to more efficient management and resource allocation. This approach promotes strategic planning in the tourism sector and helps managers make informed decisions and provide visitors with a more appropriate and satisfying tourism experience.

The study conducted by Ferreira et al. (2020) addressed the application of artificial intelligence in the management of sustainable destinations. The main objective of the research was to optimize resource allocation and promote more sustainable decision-making in this context. The researchers proposed the use of AI algorithms to analyze and process large amounts of sustainability-related data, including energy consumption, natural resource use, and carbon emissions. The results highlight the potential of AI as an effective tool for identifying measures to reduce environmental impact and implement sustainable practices in tourism destinations. By using AI algorithms, managers can access valuable information and insights about the environmental impact of tourism activities in real-time.

The analysis and processing of big data by artificial intelligence enables a deeper understanding of sustainability issues in tourist destinations. Algorithms can identify patterns and trends, providing important information for informed decision-making and more responsible management strategies. In addition, applying AI to the management of sustainable destinations also offers benefits in terms of efficiency and resource savings. By identifying problematic or inefficient areas, managers can implement corrective actions with greater precision and focus, maximizing the use of available resources.

The results of this study highlight the importance of artificial intelligence as a promising tool for promoting more responsible and conscious management in tourism destinations. The use of AI algorithms enables a more holistic approach to sustainability, taking into account multiple factors and relevant indicators. In the context of increasing concern for the environment, the application of AI in the management of sustainable destinations is an innovative and necessary approach. It can contribute significantly to the promotion of sustainable tourism that balances economic development with the conservation of natural resources and environmental protection. Thus, the study conducted by Ferreira et al. (2020) highlights the potential of AI as a powerful tool for the management of sustainable destinations, enabling a more efficient, responsible and conscious use of resources and contributing to the construction of a more sustainable and resilient tourism sector.

Another relevant study is that of Chen et al. (2019), which focuses on the application of AI for safety management in inter-municipal tourism consortia. By analyzing real-time data and detecting abnormal patterns, AI can help prevent and mitigate risks related to tourist safety. In addition, AI can be used in detecting crime trends and patterns, enabling a quick and efficient response from relevant authorities.

The use of AI in the integrated management of inter-municipal tourism consortia has also been explored in terms of offer personalization and marketing. A study by Li et al. (2018) proposed an AI model capable of analyzing tourists' profiles based on demographic data, preferences, and past behaviors. This model enabled the creation of highly segmented and personalized marketing campaigns targeting specific audiences. The results showed a significant increase in campaign effectiveness, leading to higher tourist engagement and conversion rates.

Artificial intelligence also plays a fundamental role in managing the tourism experience. Studies such as that by Wang et al. (2019) have shown how AI can be used to create personalized recommendation systems that suggest tourist attractions, restaurants, and activities based on individual interests. This approach not only improves tourist satisfaction but also contributes to a more balanced distribution of visitor flows by reducing the concentration on popular places and encouraging the discovery of less explored destinations.

The application of AI in the integrated management of inter-municipal tourism consortia also brings challenges and considerations. One of these challenges

is data privacy. The collection and processing of large amounts of tourism data raises concerns about privacy and the ethical handling of personal information. Therefore, it is necessary to implement appropriate policies and practices to ensure the security and privacy of tourists' data. Another challenge is the need for skilled professionals in the field of AI to implement and manage the necessary systems and algorithms. The lack of AI experts can limit the adoption and success of these technologies in inter-municipal tourism consortia. It is important to invest in training programs and skills development in this area to ensure that the full benefits of AI are realized.

In summary, the application of AI in the integrated management of inter-municipal tourism consortia offers several benefits, including improved resource management efficiency, cost reduction, optimized planning, and informed decision making. Recent studies demonstrate the ability of AI to enhance the tourism experience, predict tourism demand, promote sustainable destinations, ensure tourist safety, and personalize offerings and marketing. However, challenges related to data privacy and the lack of skilled professionals need to be addressed. With the right efforts, AI has the potential to revolutionize inter-city tourism management, provide tourists with a more enjoyable and sustainable experience, and drive the development of the regions involved.

2.4. Converging Literature Aspects

The studies in this discussion address various aspects related to inter-municipal tourism consortia and the use of artificial intelligence (AI) in their management process. The following table highlights the common features of the studies reviewed and points to common characteristics and trends for future research (Table 2).

In summary, studies on inter-municipal tourism consortia highlight the importance of collaboration between municipalities for regional development, while research on AI in tourism explores the potential of this technology to improve destination management, predict tourism demand, and provide personalized experiences for tourists. Trends for future research include impact assessment, sustainability, private sector participation, tourism experiences, data analytics and Big Data, and market intelligence and competitiveness.

3. Methodology Design

Due to the methodological procedures used in this article, this is qualitative research with descriptive and propositional features. Therefore, this propositional discussion aims to propose the use of AI models for the management of inter-municipal consortia in Brazil, using technological tools that allow efficient coordination and strategic management of tourism services, from the identification of opportunities to the evaluation of results, including data analysis and demand forecasting. To achieve this, the research was carried out in the following phases (Table 3).

Table 2. Summary of converging literature aspects.

Concepts	Addressed studies	Shared characteristics	Future Research
Inter-municipal Tourism Consortia	The studies by de Almeida and Viegas (2016), Bueno and Leal (2017), Ferreira and Pereira (2016), Nogarotto and Marques (2019), Pinto and Silva (2019), Schmitz and Grande (2014), and Vieira and Antonini (2014) analyze inter-municipal tourism consortia in Brazil and highlight their characteristics, challenges, and prospects for regional development. These research studies emphasize the importance of these consortia as instruments of cooperation between municipalities to strengthen tourism in a given region.	Municipal cooperation: inter-municipal consortia are forms of cooperation between different municipalities for the joint development of tourism. Regional development: consortia aim to promote regional development through tourism, focusing on increasing the supply of tourism products and services, improving infrastructure and promoting destinations. Integrated management: the studies emphasize the importance of integrated management in the consortia, covering aspects such as strategic planning, governance, tourism marketing, resource mobilization and partnerships.	Impact assessment: future research can focus on assessing the impact of inter-municipal tourism consortia on regional development, including economic, social, and environmental aspects. Sustainability: studies can examine the incorporation of sustainable tourism practices into inter-municipal consortia, taking into account natural resource conservation, social inclusion, and balanced economic development. Private sector participation: private sector participation in consortia, its contribution to tourism development, and public-private partnerships may be topics of interest for future research.
Artificial Intelligence in Tourism	The studies of Buhalis and Amaranggana (2019), Cai, McKenna, and Song (2020), Chen, Li, and Lin (2019), Li, Wang, and Liang (2018), Ferreira, Kozak, Kim, and Buhalis (2020), Nejati, Pourfakhimi, and Amini (2021), and Wang, Li, Liang, and Huang (2019) explore the application of AI in tourism and address topics such as smart destinations, tourism demand forecasting, and personalized tourism marketing.	Smart tourism destinations: The studies shed light on the concept of smart tourism destinations, where AI is used to manage and enhance the tourism experience, optimize resource management, and promote sustainability. Tourist demand forecasting: AI is used in predicting tourism demand, using algorithms and predictive models to support strategic decisions, such as capacity planning, service supply, and resource allocation. Personalized marketing: AI is used to personalize tourism marketing offers and provide recommendations and experiences based on individual tourist preferences and characteristics.	Tourist Experience: Future research may explore the application of AI to further enhance the tourist experience, including real-time personalization, virtual assistants and chatbots for customer service, and the use of technologies such as augmented reality and virtual reality. Data analytics and Big Data: AI can be used to extract valuable insights from large amounts of data collected in the tourism industry, enabling a deeper understanding of tourists' behavior patterns, market trends and preferences. Market Intelligence: Future research can explore how AI can be used to analyze the competitive environment in tourism, identify market opportunities, anticipate trends, and help formulate competitive strategies for destinations and tourism businesses.

Source: proposed by the authors.

Table 3. Methodological adopted stages.

Stages	Description
Research question	How can artificial intelligence be used in the management of inter-municipal tourism consortia?
Sources of research	The databases used for the search were Scopus, Web of Science, and Google Scholar. In addition, a manual search of journals on inter-municipal consortium management and artificial intelligence was conducted.
Inclusion and exclusion criteria for studies	The inclusion criteria were: 1) articles and books published in English and Portuguese between 1983 and 2023; 2) articles that dealt with the use of artificial intelligence in the management of inter-municipal tourism consortia; 3) articles that presented real or experimental cases of AI use; 4) articles that presented AI-based technological solutions; 5) articles that underwent peer review. The exclusion criteria were: 1) articles that did not address the use of AI in the management of inter-municipal consortia; 2) articles that addressed areas other than network management; 3) articles of a speculative or journalistic nature.
Conducting the search	The search was conducted in April 2023 using the following search terms: "inter-municipal consortia", "artificial intelligence", "consortium management", "inter-municipal tourism consortia", and "computer vision". The initial search returned 142 articles.
Selection of studies	After the initial review of titles and abstracts, 53 articles were selected for full reading. Of these, 21 were included in this approach.
Evaluation of study quality	The quality of the studies was assessed using the Critical Appraisal Skills Program (CASP), a scale for assessing study quality. The CASP is a critical appraisal tool developed in the United Kingdom and widely used in theoretical studies in management. This scale was developed to assess the methodological quality of qualitative, quantitative, and mixed-method studies. The goal of CASP is to help users critically evaluate the quality of studies to determine the reliability and validity of the results. In this article, CASP was used to conduct a systematic literature review, including questions to examine the appropriateness of the search strategy, selection of included studies, assessment of text quality, and synthesis of results.
Data analysis and synthesis	Data analysis, synthesis, and Python programming: data from publications were analyzed using narrative synthesis of results from included studies. The results were classified into thematic categories based on the main themes addressed in the studies and aligned with the proposed Python programming algorithms for the following dimensions of tourism services: Identification of opportunities, data analysis, demand forecasting, and evaluation of results.

Source: proposed by the authors.

Adopting this research stages, it was shown below the funnel diagram that illustrates the number of articles at each stage. The diagram depicts the sequential steps outlined in the text. It commenced with an initial search of 142 articles

pertaining to the utilization of artificial intelligence in the management of inter-municipal tourism consortia. Subsequently, a review of the titles and abstracts was conducted, leading to the selection of 53 articles for comprehensive examination. Following the thorough reading, the selected studies underwent quality assessment using the Critical Appraisal Skills Program (CASP) scale.

The subsequent stage encompassed data analysis and synthesis, employing Python programming for data processing. The outcomes were subsequently classified into thematic categories associated with the proposed dimensions of tourism services, namely opportunity identification, data analysis, demand forecasting, and results evaluation. It is important to note that the funnel diagram represents a sequential process whereby the number of articles decreased at each stage, culminating in a final set of 21 included scientific articles, constituting the ultimate research findings (Figure 1).

After presenting the main methodological steps of this study, the next section of this article presents the proposed artificial intelligence models for the management of inter-municipal tourism consortia, focusing on the following possibilities: identification of opportunities, data collection and analysis, demand forecasting and evaluation of results.

4. Results and Discussion

The described methodological approach enabled a systematic and comprehensive literature review on the use of artificial intelligence (AI) in the management of inter-municipal tourism consortia and provided a reliable theoretical basis for the proposal of AI models proposed and subsequently described in this text.

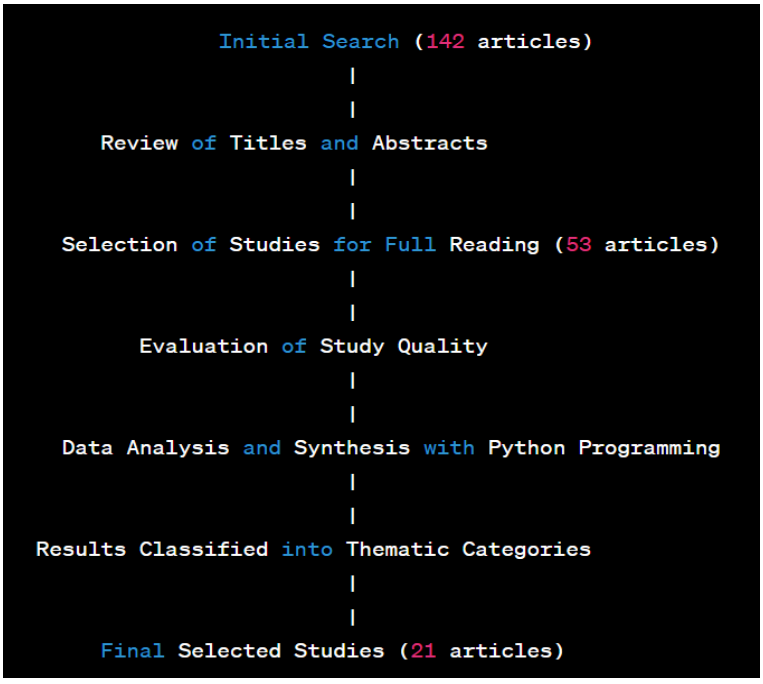

Figure 1. Research funnel diagram. Source: proposed by the authors.

This discussion provides an initial overview of the topic that includes several conceptual and technological opportunities for the application of AI in the management of inter-municipal consortia for the provision of public tourism services. These opportunities have the potential to improve municipal public management and make it an increasingly professional and accurate activity (HBR, 2021). This text gains relevance by proposing AI models that can be implemented in the context of Brazilian municipalities and providing a path for specific research and modeling.

In this context, inter-municipal tourism consortia are considered as forms of collaboration between organizations that share resources and expertise to achieve common goals. Effective management of these partnerships is important to ensure the success and sustainability of the consortia. With the advancement of technology, AI has emerged as a powerful tool to improve various aspects of consortium management.

Therefore, this article explores how AI can be used in different phases of the management process, from identification of opportunities, data collection and analysis, demand forecasting and evaluation of results, and provides Python algorithms examples for each of these phases.

4.1. Identification of Opportunities Python Algorithm

Artificial intelligence (AI) can play an important role in identifying opportunities for consortia formation through data analysis and market patterns. Machine learning algorithms can analyze large amounts of information about companies, sectors, and economic trends, allowing them to identify potential partners based on specific criteria. For example, these algorithms can assess the financial performance of companies within a given sector, identify companies with complementary skills or capabilities, and identify potential collaboration opportunities. They can also consider factors such as geographic proximity, technological know-how and market positioning to identify suitable partners for consortia formation.

In the following figure, a Python algorithm is proposed to identify opportunities for managing inter-municipal tourism consortia.

The five companies listed in Algorithm of **Figure 2** represent illustrative possibilities for use in five different municipality departments. Since the algorithm is designed to be generic, specific names of the municipalities are not provided. These companies can be applied in various situations, and the number of companies can be adjusted to accommodate larger or smaller scenarios. Then, in this proposed example, a dataset of tourism programs is defined, along with their characteristics such as revenue, growth rate, profitability, and market share, as found in Ferreira, Kozak, Kim, and Buhalis (2020). Subsequently, the data is normalized to ensure that all variables are on a similar scale. The K-Means clustering algorithm is then applied to group the programs based on their characteristics. This enables the selection of any two groups for demonstration purposes.

```python
import pandas as pd
from sklearn.cluster import KMeans

# Sample dataset of companies and their characteristics
companies = {
    'Company': ['Company A', 'Company B', 'Company C', 'Company D', 'Company E'],
    'Revenue': [100, 150, 200, 120, 180],
    'Growth': [0.05, 0.1, 0.12, 0.08, 0.15],
    'Profitability': [0.1, 0.15, 0.2, 0.12, 0.18],
    'MarketShare': [0.08, 0.1, 0.15, 0.1, 0.12]
}

df = pd.DataFrame(companies)

# Define the criteria for potential partners
target_revenue = 180
target_growth = 0.1
target_profitability = 0.15
target_market_share = 0.12

# Normalize the data (optional, but recommended)
df_normalized = (df - df.mean()) / df.std()

# Apply K-means clustering algorithm to identify potential partners
kmeans = KMeans(n_clusters=2, random_state=0).fit(df_normalized[['Revenue', 'Growth', 'Profitability', 'MarketShare']])

# Get the cluster labels
df['Cluster'] = kmeans.labels_

# Filter potential partners based on the cluster and criteria
potential_partners = df[(df['Cluster'] == 1) &
                        (df['Revenue'] >= target_revenue) &
                        (df['Growth'] >= target_growth) &
                        (df['Profitability'] >= target_profitability) &
                        (df['MarketShare'] >= target_market_share)]

# Display the potential partners
print("Potential Partners:")
print(potential_partners['Company'])
```

Figure 2. Python algorithm for identification of opportunities. Source: Proposed by the authors.

Finally, potential partners are selected based on the group and certain criteria (revenue, growth, profitability, and market share). This code prints the names of the potential partners that meet the criteria. Managers of inter-municipal tourism consortia can customize the dataset and criteria to their specific needs. They can also explore and try different machine learning algorithms or adjust the number of groups according to their needs.

4.2. Data Collection and Analysis Python Algorithm

Data collection and analysis are fundamental components of consortium man-

agement. AI can be used to process complex data sets and gain insights from them. For example, the use of AI in consortium management can be based on studies and advancements in data mining, machine learning, and data analytics. Sarli et al. (2017) reviewed various approaches and data analytics techniques used in business consortia and highlighted the potential of these techniques to improve management and decision making in these collaborative arrangements.

The technologies mentioned in this study are capable of processing large amounts of data collected by consortia organizations and deriving valuable insights from it. The following **Figure 3** shows a Python algorithm capable of performing data analysis for the management of inter-municipal tourism consortia and identifying performance patterns of consortia organizations, highlighting strengths and areas for improvement.

The presented algorithm describes a procedure for analyzing a data set contained in a file named "consortium_data.csv". The goal is to identify performance patterns in consortium organizations using the K-means algorithm. It has suggested the following steps:

- Loading the data: the code reads the CSV file that contains the relevant data for the analysis. We assume that the file is named "consortium_data.csv".
- Preprocessing: before applying the K-Means algorithm, the data must be prepared for analysis. This may include removing missing values, normalizing the data, or any other necessary treatment to ensure data quality.
- Conversion of categorical variables: if the dataset contains categorical variables (e.g., strings representing categories), these variables must be converted to numeric values. In this case, the algorithm uses Label Encoder encoding, which assigns an integer number to each unique category. The Label Encoder is often used to encode categorical variables into numeric values so that machine learning algorithms can work with them.

```
import pandas as pd
import numpy as np

# Load consortium data
data = pd.read_csv('consortium_data.csv')

# Perform data analysis
# Example: Calculate the average performance of consortium organizations
mean_performance = data['performance'].mean()

# Identify strengths and areas for improvement
# Example: Organizations with performance above average are considered strengths
strong_organizations = data[data['performance'] > mean_performance]

# Display results
print("Average performance: ", mean_performance)
print("Strengths: ")
print(strong_organizations)
```

Figure 3. Python algorithm for data collection and analysis. Source: Proposed by the authors.

- Column selection: the algorithm selects the "Organization" and "Performance" columns from the dataset for analysis. These columns contain the relevant information to identify performance patterns in consortium organizations.
- Application of the K-means algorithm: the K-means algorithm is applied to the selected data. K-means is an unsupervised learning algorithm that groups the data into k clusters, where k is a user-defined parameter. In this example, the value of k is fixed at 3, but it can be adjusted depending on the needs of the study.
- Adding cluster labels: after applying K-means, the code adds cluster labels to the data. Each consortium organization is assigned to a cluster based on its performance.
- Displaying the results: the code displays the result of the analysis, which consists of the original data and the added cluster labels. This allows visualization and interpretation of the performance patterns determined by the algorithm.

This algorithm is useful for examining and identifying clusters or performance patterns in a dataset of consortium organizations and facilitates analysis and decision making regarding these organizations.

4.3. Demand Forecasting Python Algorithm

Anticipation of future demand is of utmost importance for strategic planning of tourism consortia. The study by Poudel, Gurung, and Khanal (2019) discusses how artificial intelligence (AI) contributes to demand forecasting based on historical data and relevant variables. Poudel et al. (2019) present a comparison between different machine learning techniques, including AI algorithms, for demand forecasting in the tourism sector. The researchers demonstrated that AI algorithms such as artificial neural networks (ANNs), support vector machines (SVMs), and decision trees are able to make accurate and efficient predictions based on historical data and relevant variables. The results of the study show that these AI algorithms are able to analyze consumption data, market behavior, and seasonal factors to predict demand for specific tourism products or services. The AI was able to detect complex patterns in the data, recognize non-linear relationships between variables, and adapt to seasonal changes or special events that affect demand.

According to these authors, tourism consortia can benefit from using AI techniques in demand forecasting in several ways. First, they gain a more accurate and detailed view of future demand, which enables more efficient and effective strategic planning. In addition, the ability to predict and adapt to fluctuations in demand helps optimize resource allocation and decision-making regarding pricing, promotions, and services offered. In other words, the scientific study by Poudel et al. (2019) provides theoretical evidence to support the claim that AI can be used in demand forecasting in the tourism sector. Analyzing historical

data and relevant variables using AI algorithms enables accurate and efficient demand forecasting that supports strategic planning of tourism consortia and provides competitive advantages in the market. The following Figure 4 shows an algorithm that can forecast tourism demand.

This proposed algorithm aims to predict tourism demand based on historical and future data. The code assumes that you have stored the historical data in a CSV file named "historical_data.csv" which contains columns for "consumption", "market behavior", "seasonal factors" and "demand" The future data is stored in another CSV file named "future_data.csv" with the same columns. The algorithm uses the Pandas library to load and process the data. It creates separate input variables (X) and the target variable (y) from the historical data. Then it trains a linear regression model from the scikit-learn library using the historical data. After training the model, the algorithm loads the future data and extracts the input variables for prediction (future_X). This data is passed through the trained model to obtain the predicted demand for the future period. Finally, the algorithm prints the predicted demand values.

4.4. Results Evaluation Python Algorithm

Evaluating outcomes is essential for monitoring consortia performance and identifying opportunities for improvement. AI can be used to analyze key performance indicators, compare results to established goals, and identify relevant patterns or trends to improve future strategies. The following Figure 5 illustrates an algorithm that can perform the evaluation of results for inter-municipal tourism consortia.

```
import pandas as pd
from sklearn.linear_model import LinearRegression

# Load historical data
data = pd.read_csv('historical_data.csv')

# Prepare the data
X = data[['consumption', 'market_behavior', 'seasonal_factors']]
y = data['demand']

# Train the linear regression model
model = LinearRegression()
model.fit(X, y)

# Predict future demand
future_data = pd.read_csv('future_data.csv')
future_X = future_data[['consumption', 'market_behavior', 'seasonal_factors']
predicted_demand = model.predict(future_X)

# Print the predicted demand
print("Predicted demand for the future period:")
print(predicted_demand)
```

Figure 4. Python algorithm for demand forecasting. Source: Proposed by the authors.

```python
import pandas as pd

# Load consortium data
consortium_data = pd.read_csv("consortium_data.csv")

# Calculate key performance indicators
indicators = consortium_data.groupby("consortium").mean()

# Set established targets
targets = {
    "consortium1": 100,
    "consortium2": 150,
    "consortium3": 120
}

# Compare results with targets
indicators["target"] = indicators.index.map(targets)
indicators["achieved"] = indicators["indicator"] >= indicators["target"]

# Identify relevant patterns or trends
trends = consortium_data.groupby("month")["indicator"].mean()

# Print the results
print("Key Performance Indicators:")
print(indicators)
print("\nComparison with Established Targets:")
print(indicators[["indicator", "target", "achieved"]])
print("\nPerformance Trends:")
print(trends)
```

Figure 5. Python algorithm for results evaluation. Source: Proposed by the authors.

In this example, it is assumed that there is a CSV file named "dados_consorcios.csv" that contains the consortium data, with columns such as "Consortium", "Indicator" and "Month" The algorithm loads this data using Pandas and calculates the main performance indicators for each consortium. It then defines the set targets in a dictionary. The algorithm compares the achieved results with the defined targets and adds the columns "target" and "achieved" to the indicator Data Frame. Finally, the algorithm identifies performance trends by grouping the data by month and calculating the average of the indicator for each month. The results are printed on the console, showing the performance indicators, the comparison with the set targets and the performance trends.

From the proposal of these algorithms, the application of AI models in the management of tourism consortia offers several opportunities to improve the efficiency, decision-making, and overall performance of these partnerships. The examples provided in this article demonstrate how AI can be applied at various stages of the consortium management process, whether it is opportunity identification, data collection and analysis, demand forecasting, and outcome evalua-

tion. However, it is important to emphasize that successful implementation of AI requires an integrated approach that considers factors such as data quality, governance, and ethics in the use of technology.

5. Final Considerations

This study analyzed the contribution of artificial intelligence (AI) application to the integrated management of inter-municipal tourism consortia, with the aim of improving planning, decision-making, and project implementation in municipal tourism departments. Based on literature review and analysis of the characteristics of existing consortia, it was found that AI can be applied in different phases of consortia management, from identification of opportunities to evaluation of outcomes, including data analysis and demand forecasting.

One of the main contributions of this study was the identification of opportunities to apply AI in the management of inter-municipal tourism consortia. Based on the results obtained, managers can explore the use of AI in identifying and analyzing relevant data, forecasting demand, monitoring performance indicators, and even personalizing tourism experiences. These applications can lead to more efficient management, enable data-driven decisions, and promote sustainable growth of the sector.

The four detailed application categories in this study—identifying opportunities, evaluating results, analyzing data, and forecasting demand—can be approached with Python code and offer practical suggestions for managers. In the opportunity identification category, Python code was proposed to analyze market and regional tourism data to identify trends, patterns, and promising opportunities. This enables managers to make informed and strategic decisions to drive tourism development in communities. In turn, in the demand forecasting category, the use of Python code can help managers analyze past and current trends to predict future demand for services and tourist attractions. This can include using machine learning models and statistical techniques to forecast seasonal demand, identify tourist behavior patterns, and optimize resource allocation.

Data analysis is another area where Python code can be valuable. Managers can develop algorithms and scripts to process large amounts of tourism-related data to gain a deeper understanding of tourists' needs and preferences. This can include sentiment analysis of hotel reviews, data processing of reservations, and analysis of social media data to understand tourists' opinions. In addition, the use of Python code allows managers to collect and analyze data on the performance of inter-municipal tourism consortium projects and initiatives to evaluate results. This can include indicators of tourist satisfaction and economic and environmental impact, among others. Using this information, managers can evaluate the success of the actions undertaken and adjust as needed.

These practical approaches, based on Python code, provide managers with concrete tools for implementing AI in the management of inter-municipal tour-

ism consortia. By using these techniques, managers can make data-driven decisions, optimize resources, and drive sustainable industry development. In addition, a comparative analysis of successful cases of inter-municipal tourism consortia that have used AI can provide valuable insights into the most efficient practices and approaches in this context.

In addition, the results of this study suggest that future research should be conducted to evaluate the real-world impact of implementing integrated AI models in managing these consortia. Empirical research that analyzes real-world applications of AI in this context can provide valuable insight into the benefits and challenges faced by managers. In addition, it is critical to explore the potential for integrating emerging technologies such as the Internet of Things (IoT) and virtual reality (VR) with AI. These complementary technologies can add value to the integrated management of consortia and provide tourists with a more immersive, personalized, and efficient experience.

By promoting efficiency in decision making, AI can help optimize resource allocation, improve demand forecasting, and identify growth opportunities. This leads to more effective management of consortia, enabling them to better respond to tourists' needs and expectations. In this direction, the application of AI can contribute to the sustainable development of the tourism sector. Through route optimization, smart energy and resource management, and real-time data analysis, it is possible to reduce environmental impact and promote more sustainable practices in the industry. However, it is important to emphasize that the successful implementation of AI requires a careful approach. Ethical issues such as privacy and transparency of algorithms must be carefully considered and addressed to ensure that AI is used responsibly and fairly.

Then, this study contributes to the scientific literature by proposing a practical application of AI using Python code that provides managers with a tangible and replicable approach to improving the management of inter-municipal tourism consortia. These contributions, along with the suggestions for future research, provide a solid foundation for further studies that promote continued progress in the professional management of inter-municipal tourism consortia and provide more effective outcomes for the industry.

Finally, it is important to point out some limitations encountered in conducting this study. First, there is the possibility of publication bias and a limitation to articles published only in English and Portuguese, which may limit the scope of the study. In addition, caution should be exercised when generalizing the results, as there may be a lack of empirical validation of the proposed models. In addition, contextual factors such as local politics, culture, and available resources may significantly influence the application of artificial intelligence in managing inter-municipal consortia. Unfortunately, these contextual factors were not adequately addressed in this theoretical study. Future research should therefore address these limitations and provide a more comprehensive understanding of the topic.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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