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Article

Ways to Improve the Optimal Location of the Tourism Agglomeration on the Base of Modern Models

Nurbek Toshev Janon ugli[1]

1.Karshi State University Department of Tourism and Marketing independent researcher
* Correspondence: nurbektoshev@gmail.com

Abstract: In this article, the ways of improving the optimal placement of tourism agglomerations based on modern models and the factors affecting the optimal placement of tourism agglomerations in Kashkadarya region are highlighted, and it is necessary to study the demand of domestic and foreign tourists in the development of tourist agglomerations in the region. The processes of forming a marketing strategy and diversifying tourism services to attract domestic and international tourists are written.

Keywords: Optimal placement, tourism agglomeration, modern models, domestic and international tourists, diversification of tourism services.

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1. Introduction

Geographical, cultural, economic and infrastructural characteristics of the region should be taken into account when determining the factors affecting the optimal placement of tourism agglomerations in Kashkadarya region. Kashkadarya region is distinguished by rich natural resources, historical monuments and cultural heritage. At the same time, the improvement of the region's development opportunities and tourist infrastructure has a significant impact on the optimal location of tourism agglomerations in the region. The main natural resources and attractions of Kashkadarya region are mountains, lakes and forests. Places such as the Kitab-Karshi mountain range, Hisar reserve located in this area are of great interest to tourists. Such places can be developed on the basis of ecotourism and natural landscapes. Hisar mountains are suitable for ecotourism and extreme tourism, which helps in the development of tourism. There are places with ancient history in Kashkadarya region, such as Shahrisabz and its surroundings, monuments of Amir Temur era, Dorut-Tilovat, Dorut-Saodat complexes. These historical places are of great importance in attracting tourists. Shahrisabz is included in the list of world cultural heritage with architectural monuments from the time of Amir Temur, and the tourism potential of this area is high.

Analysis of literature on the topic. From foreign scientists, Richard Butler- Engaged in the theory of tourism cycles and territorial development, [1] especially conducted

many studies on the dynamics of development of tourist places near large cities. In his research,studied the development cycles of tourism places in depth. John Urry - Through his book The Tourist Gaze, he developed fundamental theories about the sociology of tourism and the development of tourist destinations around major cities.[2] presents a new and innovative approach to tourism. Urry introduces the concept of the "tourist gaze," which explains the way in which tourists view experiences in aesthetic, cultural, and social terms by traveling to places they are unfamiliar with. He examines this experience through contemporary society and its cultural phenomena, analyzing the social and economic aspects of tourism. Noting that tourists' gaze is primarily visual, Urry considers tourism as part of a global sociology and communication process. Edward Inskeep - Researched the development of cities and tourist areas near them, his works focused on the study of planning and sustainable development of tourist areas.[3]

2. Materials and Methods

The research process used a systematic approach, logical and comparative methods of analysis, systematic analysis, comparative analysis, monographic analysis, logical and comparative methods of analysis, complex approach, expert assessment, multivariate forecasting, analysis and synthesis, abstract-logical analysis, econometrics, observation, comparison, correlation, regression, statistical and economic analysis, comparative analysis, and monographic analysis methods.

3. Results

In our opinion, the most important thing in the region is transport connections and infrastructure, and the fact that it does not have large direct transport routes can cause difficulties in attracting tourists to the region. Therefore, it is necessary to develop internal transport infrastructure in the region, modernize railways and highways, and create the possibility of easy access to tourist places. It is necessary to improve convenient transport routes and bus networks from Karshi to Shahrisabz, Kitab and mountainous areas.

In the development of tourist agglomerations in the region, it is necessary to study the demand of domestic and foreign tourists. In order to attract the flow of domestic and international tourists, it is necessary to formulate a marketing strategy and diversify tourism services. This helps to increase the uniqueness of the region and its role in the tourism market. For foreign tourists interested in the history and culture of the region, special tours to Shahrisabz and other historical places can be offered.

Development of tourist agglomerations requires investment in infrastructures, service sectors and government funding. It is also necessary to improve the economic efficiency of hotels, restaurants, tourist attractions and recreation areas.

Special attention should be paid to environmental issues in the development of tourist agglomerations. The development of tourist infrastructure near natural parks such as Hisar Nature Reserve should be carried out in accordance with the principles of ecological sustainability. At the same time, it is necessary to develop environmentally friendly tourism that does not harm the environment. Natural resources can be preserved by creating ecotourism centers and nature-friendly recreation areas.

The climate of the region can be favorable for tourism throughout the year, but extreme tourism or sports can be developed in the mountainous regions during the winter season. Also, during the summer season, tourists can be attracted through cultural events and festivals. In the winter season, skiing or mountain tours can be organized, and in the summer, cultural festivals and events can be organized. Special attention should be paid to the security issues of tourist areas. It helps to create comfortable and safe conditions for tourists. Political stability and security measures will lead to more tourists. The flow of local and international tourists can be increased by strengthening

the security measures at the tourist sites. For optimal placement of tourism agglomerations in Kashkadarya region, it is necessary to take into account natural resources, historical monuments, transport infrastructure, economic efficiency, environmental issues, cultural events and security issues. The province can make the most of its natural and cultural heritage and take necessary measures for the diversification and sustainable development of tourism. Optimum placement will greatly contribute to increasing tourist flow and economic development in the region.

In our research, based on our theoretical studies, we studied the classification of evaluation tools and approaches using several mathematical formulas and optimization models in an algorithmic approach for the optimal placement of tourism agglomerations.

Several mathematical formulas and optimization models can be used in an algorithmic approach for optimal placement of tourism agglomerations in the province. Through these formulas, it is possible to calculate the optimal location of tourism resources and the effective distribution of infrastructure. It is used to forecast tourist flows taking into account the distance between tourism agglomerations and population density. This model works like the law of gravity.

$$Tij= Pi×Pj / dij2$$

Here Tij -the flow of tourists between places i and j; Pi , Pj - population or touristic potential of places i and j; dij is the distance between locations i and j.

This model can be used to calculate the distance between major tourist centers such as Shahrisabz and Karshi and the attraction of tourists. With this, it is possible to determine in which direction tourists move more.

Lagrange multipliers are used in solving constrained optimization problems. If natural resources, infrastructure and economic resources are limited in the placement of tourism agglomerations, optimal placement is determined through Lagrange multipliers.

$$L(x1,x2,l)=f(x1,x2)+l(g(x1,x2)−c)$$

where f(x1, x2)— functions to be optimized (for example, economic benefit, tourist flow); g(x1, x2) is a constraint function (for example, infrastructure, resources); l — Lagrange multiplier; c is the limit value.

Through this algorithm, resources (natural, infrastructural, financial) can be used for optimal placement of tourist centers in limited situations.

The location of tourist spots is determined in such a way as to minimize the total distance between tourists. This model helps to find the optimal location for tourists to reduce the distance between places and use services efficiently.Also called distance minimization model (P-median model).

$$Z=\sum i=1n\sum j=1m\ hi×dij×xij$$

Here: Z- total cost or distance (should be minimized); hi is the flow of tourists at point i; dij is the distance between points i and j; xij is 1 if location i is connected to service location j, 0 otherwise.

It can be used to minimize the distance between tourist service places (hotels, restaurants and recreation areas). This will reduce travel costs and increase convenience for tourists. This is malso called asofa minimization model (P-median model). Bit is an optimization model used in operations research and logistics, whose main goal is to locate service locations in tourism centers in such a way that they minimize the distances connected to customers or users. This model is used to optimize the placement of service tourism centers in a particular geographic area.The main purpose of the P-median model— selection and placement of service centers in such a way as to minimize the total distance between different points. It involves placing customers or users at the closest distance to service centers through "median points". In this model, the number of

service centers will be limited, and the number of these service centerspexpressed through The main parts of the p-median model are:

4. Discussion

1. Place Set (I): These are places where services are provided or where customers are located. These can be areas visited by tourists or service points.
2. Service Center Collection (J): These locations are selected as service points (p service centers). These centers are placed to serve customers and the value of p is predetermined.
3. Distances (dij): Distance between each customer or point i and each service center jo. The goal is to minimize these distances.
4. Decision variables (xij): xij = 1 if customer i is assigned to service center j, otherwise xij = 0.

Restrictions:

1. Each customer must be connected to exactly one service center:

$\sum j=1m\ xij=1\forall I$

This restriction ensures that each customer is connected to one service center.

2. Only p service center should be selected:

$\sum j=1m\ yj=p$

This restriction ensures that only p centers are selected.

3. If the service center does not exist, it will not be serviced:

$xij \leq yj \forall i,j$

If service center j is not selected, then yj = 0, in which case xij = 0, which means that customer i is not served by this location.

The purpose of the P-median model, mMinimize costs.In the P-median model, service centers are located at the closest distance to customers. This reduces overall travel costs or time for tourists or customers. Second mchoosing arkas, p predetermined service centers are selected and their locations are optimized. Also, each customer or point is connected to the nearest center for him.

Let's say that there are 5 tourist centers to be chosen for tourists in Kashkadarya region, and there are 10 potential places in the region. The P-median model selects 5 centers among these 10 locations, considering the shortest distance and the most convenient service options for tourists. The distance from each location to the service centers and the flow of tourists are calculated and optimal placement is made. The P-median model is an effective tool for optimal placement of tourism agglomerations. It increases the flow of tourists and the quality of service by minimizing the distance between tourists and service centers. By applying this model in Kashkadarya region, it is possible to place tourist centers in the most convenient places and increase the satisfaction of tourists.

Also called the transport and location model (Huff's Model).The Huff model is used to calculate the probability of potential customers choosing tourist destinations. Tourists choose tourist agglomerations based on their attraction. Gravity depends on the distance and the attractiveness of the place.

$Pij=Aj\ /dijb\ /\ \sum k=1n\ Ak/\ dikb$

Pij— the probability of going from place i to place j.

Aj — attractiveness of place j (for example, the ability to attract tourists).

dij — the distance between places i and j.

b— distance sensitivity parameter.

k— the number of places k, which means all the places to be chosen among the tourists of k places i.

Huff's modelis a model used in the tourism, trade, logistics and service industries to calculate the probability of consumers (or tourists) visiting a particular location. The

model states that the attractiveness of a place and the likelihood of visiting it is directly related to the attractiveness of the place, while distance has an inverse effect. Thus, tourists tend to go more to nearby places, but even if the distance is far, places with high attractiveness attract more tourists.

Attractiveness (Aj): Attractiveness refers to the ability of a tourist destination to attract more tourists. This is influenced by the cultural heritage of the place, natural beauty, entertainment and other attractions, services quality infrastructure, marketing and other factors. Distance (dij), which represents the distance of each tourist from point i to point j. As the distance increases, the attractiveness of the place decreases, which means that the probability of going to distant places is lower. Probability (Pij) refers to the probability of a tourist visiting destination j from location i.

The working principle of Huff's model consists of Attractiveness factor and Distance factor. Attractiveness factor, attractive places attract more tourists. Attractiveness is determined by infrastructure, historical and cultural monuments, environmental resources, entertainment services and other factors. The distance factor means that tourists become less likely to visit as the distance increases, that is, they visit nearby places more.

To the working process of the model, hevaluating the attractiveness of each place: In the first step, it is necessary to determine the force of attraction (attraction) for each of the tourist places. This includes the place's history, natural scenery, infrastructure, service level and marketing activities.Tourists calculate the distance between places:The distance from each tourist location to the tourist location is calculated. These distances are mainly evaluated according to the possibilities of transport and movement.Probability calculation:Through the model, the probability of each tourist visiting a certain place is calculated. This probability shows how much the tourist wants to go from place to place and which place he prefers.

For example, there are three tourist places in Kashkadarya region: Shahrisabz, Kitab and Hisar Mountains Reserve. Let the attractiveness and distance of each location be:

- Shahrisabz: attractiveness (Aj) = 100 (due to historical monuments),
- Book: attractiveness (Aj) = 60 (due to ecotourism and nature),
- Hisar mountains: attractiveness (Aj) = 80 (due to natural scenery and extreme tourism).

The main part of the population is located in the city of Karshi. Let the distance from Karshi to these places be as follows: Karshi - Shahrisabz: 100 km, Karshi - Kitab: 120 km, Karshi - Hisar mountains: 150 km.

Probability calculation (Pij):

1. Probability of going from Karshi to Shahrisabz:

PKarshi,Shahrisabz=100/1001/(100/1001+60/1201+80/1501)

In this case, we calculate the probability of going to Shahrisabz.

2. Probability of going to Book against:

Against,Book=60/1201 / (100/1001+60/1201+80/1501)

Probability of going from Karshi to Hisar Mountains:

PKarshi,Hisor=80/1501/(100/1001+60/1201+80/1501)

As a result of these calculations, it is determined which place the tourists are most likely to visit.

Advantages of Huff's model:

- Simplicity: The model is relatively simple and easy to understand and can be used to forecast the flow of tourists between different destinations.
- Working with attraction and distance: Enables accurate forecasts by considering the attractiveness of a place for tourists and the distance between places.
- Practical application: Can be used in tourism development, shopping center placement and other similar fields. Huff's model is a powerful tool for the optimal

placement of tourism agglomerations because it allows to determine the probability of tourists visiting a place. This model can be used to determine which places tourists prefer in Kashkadarya region, which tourist centers attract more visitors. Through Huff's model, tourism centers can be effectively located by considering the distance and the attractiveness of the place.

This model can be used to calculate the probability of tourists choosing centers such as Shahrisabz or Karshi. It is also used to evaluate the attractiveness of other places in the region for tourists.

Efficiency analysis (Data Envelopment Analysis - DEA) The DEA method is used to measure the efficiency of tourist agglomerations. Through this method, it is possible to determine how effectively tourist centers use their resources. As a result of the performance, instructions are given to implement the optimal placement.

$\theta=\sum i=1m\ uiyi\ /\sum j=1n\ vjxj$

Th- efficiency coefficient; yi - outputs (for example, tourist flow, income);

xj- inputs (for example, resources, infrastructure); ui, vj are weighting coefficients.

Application in Kashkadarya region, tcan be used in evaluating the level of efficient use of uristic resources and optimizing the existing infrastructure.

Simulation models (Agent-based modeling), virtual models of tourist movement can be created through simulation models. These models make it possible to predict the directions of movement of tourists, the choice of place and the probability of using services. It is possible to determine the optimal placement of tourism agglomerations based on various scenarios. It is a method of modeling complex systems at the level of individual "agents", which allows us to understand the entire activity of the system through the interaction of agents. ABM is used to solve difficult and complex problems, especially in tourism, ecology, economy, transport and similar fields. In the field of tourism (ABM), it is possible to model the optimal placement of tourist agglomerations and the process of managing tourist flows by simulating the actions and interactions of agents - that is, tourists, tourist objects, service points or local residents. Main features of ABM:

1. Agents: Agents are the main elements that act in the system. In tourism, agents can be tourists, tourist attractions, hotels, vehicles or other service points.
2. Rules: Each agent acts according to certain rules. For example, tourists make a choice based on factors such as distance, price, attractiveness of the place when visiting places of interest.
3. Interactions: Agents interact, exchange information and make decisions within the system. For example, tourists may change their decision depending on the quality of service or transportation options.
4. Achieving balance: By looking at the interactions of each agent of the system, ABM determines how the entire system behaves. The decisions these agents make based on their behavior can bring the system into equilibrium.

The application of ABM in the field of tourism is to simulate the flow of tourists:

ABM can be used to simulate how tourists move to different locations. For example, tourists acting as agents visit attractions or other tourist facilities and make decisions based on their experiences.

How tourists move from one place to another, which places they prefer and how they use services are simulated. Modeling transport and infrastructure impacts:

ABM can be applied to study the impact of transport networks on tourist flows. For example, agents model how to reach tourist centers by means of transport and which means of transport are more efficient.

Through this, the most efficient transport routes can be identified and services can be improved. Through ABM, it is possible to determine the effectiveness of the placement of tourism centers, hotels, restaurants and other tourist services. Hotels or tourists are modeled as agents, and interactions between them are analyzed. For

example, when determining the place where a new hotel will be built, ABM can be used to study the impact of this place on the flow of tourists. ABM can be used to improve tourism services and to study how services are perceived by tourists. Tourists evaluate the quality of services and then use this information to make decisions. For example, tourists can exchange opinions about attractions and choose which places to visit based on these opinions.

ABM is useful in analyzing which tourist attractions attract the most tourists and how tourist attractions should be positioned to balance tourist traffic. In this way, the flow of tourists is prevented from increasing in certain places and tourists are evenly distributed among the attractions. Each agent makes decisions and acts according to its own rules. For example, a tourist agent can choose a place with the shortest distance, but the highest attractiveness. Agents can cooperate or compete with each other. For example, tourists get information about places visited by more tourists and change their decisions based on that. Individual decisions and interactions of agents shape the overall behavior of the system. This behavior generally determines the flow of tourists, the quality of services and other factors. For example, there are Shahrisabz, Kitab, and Hisar reserve tourist facilities in Kashkadarya region. With the help of ABM, it is possible to model how tourists visit these objects: Each agent acts as a tourist, and the rules for choosing which object to visit are assigned to him. For example, a tourist chooses the most attractive or the shortest distance. Tourists make decisions based on the attractiveness and distance of attractions. For example, Shahrisabz is highly attractive because it has historical monuments belonging to Amir Temur. Tourists exchange information with each other, determine which places are most interesting and change their decisions. As a result of the simulation, it is possible to determine which places are most visited by tourists and the effectiveness of tourist services. Through this, decisions are made on the optimal placement of tourist facilities or infrastructure improvements.

Advantages of ABM ABM studies complex systems at the level of individual agents, helping to understand how the system as a whole behaves. ABM takes into account the interactions between agents, thereby providing a more accurate representation of how changes occur in the real world. Through ABM, agents can adapt to the environment and change their decisions, which ensures that the system is dynamic and adaptive. In the field of tourism, it is an effective tool for analyzing the flow of tourists, the efficiency of services and the optimal location of tourist attractions. With ABM, tourists, service centers or tourist facilities are modeled as agents and how the system works is studied. This model can be important in the optimal placement of tourist objects in Kashkadarya region and in balancing the flow of tourists.

Application in Kashkadarya region,By simulating the flow of tourists in Shahrisabz and Kitab-Karshi regions, it is possible to forecast where infrastructure development is most effective. The activities carried out during 2022-2023 according to the program of actions to increase the efficiency of the Tourism Department of Kashkadarya region and achieve target indicators (Table 1) are shown.

Table 1

Development of infrastructure in Kashkadarya region by simulating the flow of tourists

T/r	**Basic criteria**	**Unit of measure**	**2022 indicator**	**2023 year**		
		*(co*indicator)		*plan*	*in practice*	*%*
1	Organization of the visit of foreign tourists.	a thousand people	53	210	222.3	**105.9**

2	Achieving tourism services export volume indicators.	million US dollars	11.3	42.0	44.9	**106.9**
3	Increase the flow of local tourists	a thousand people	1485	1822	2108.8	**115.7**
4	Setting up deployment tools.	together	277	31	32	**103.2**
5	Establishment of new tour operators and travel agents	together	23	4	13	**325.0**
6	Organization of tourist information centers	together	3	3	4	**133.3**
7	The number of sanitary and hygiene stations to be established	together	547	50	79	**158.0**
8	The number of tourist facilities where Wi-Fi points will be established	together	53	40	69	**172.5**
9	The number of tourism objects where road signs will be installed	together	55	20	63	**315.0**
10	The number of investment projects implemented by entrepreneurs in the field of tourism	together	86	84	90	**107.1**
11	Jobs created in tourism and related sectors	in person				
12	Tourist class vehicles	together	33	35	40	**114.3**
13	The number of tourism facilities established on the basis of the principle of public-private partnership	together	2	6	11	**183.3**
TOTAL:			**2628.3**	**2347**	**2777**	**118**

In Table 1 When analyzing the planned and actual results of 2022 and 2023 according to the indicators, the visit of foreign tourists: in 2023, the visit of foreign tourists was planned to be 210 thousand people, and in practice this figure reached 222.3 thousand people, and compared to this plan, 105 .9%. The growth has been significant and the flow of foreign tourists has increased. In the plan, the volume of export was indicated in the amount of 42 million US dollars, but in practice this indicator reached 44.9 million US dollars, that is, 106.9% compared to the plan. This also shows positive dynamics in the export of tourism services. The flow of local tourists, the plan for the flow of local tourists in 2023 was 1822 thousand people, and in practice it was 2108.8 thousand people. This is 115.7%, showing a significant increase in the number of domestic tourists. The activity of placement facilities, if it is planned to open 31 placement facilities in the plan, in practice this indicator was 32 units and is 103.2% compared to the plan. In the plan, 4 new tour operators and travel agents are planned to be launched, but in practice 13 tour operators have started their activities, which is much higher than the plan (325%). 4 out of 3 planned information centers were established,

which was 133.3% compared to the plan. In the plan, it is planned to establish 50 new sanitary-hygiene branches, but in practice 79 have been established. This is 158%, with good growth in sanitation infrastructure. It was planned to establish 40 Wi-Fi points in the plan, but in practice this figure reached 69, which is 172.5% higher than the plan. In the plan, 20 road signs were expected to be installed, but in practice, this figure reached 63, that is, 315%. In the plan, it is planned to implement 84 investment projects, but in practice this indicator reached 90 and made 107.1% compared to the plan. In the plan, it was expected that 35 tourist vehicles would be added, but in practice, this indicator reached 40 and was 114.3% compared to the plan. According to the principle of public-private partnership, 6 objects are planned in the plan, but in practice this indicator has reached 11 and 183.3% of the plan has been achieved. In the analysis of the total indicators, 2777 results were shown in practice, an increase of 118% compared to the plan. These indicators show overall growth in the tourism sector, introduction of innovations and expansion of tourism services. In particular, high results were recorded in the number of foreign and domestic tourists, investments and creation of new services. These growth indicators show the effectiveness of the activities carried out in the field of tourism development and infrastructure improvement in the country.

5. Conclusion

In summary, different types of data are needed to create and simulate a process. This information allows for accurate modeling of agents' behavior, their interactions, and their relationship to the environment. Below are the main data types used in ABM. Different agents are modeled in ABM. For example, in tourism, agents can be tourists, tourist attractions, hotels or local service points. The type of each agent and its function are clearly defined. For tourists: demographic information (age, gender, income level), purpose of travel, budget, probability of visit. For tourist facilities: attractiveness of the place, quality of services, location, price and level of comfort. For hotels: location, number of rooms, prices, category of services. It is determined how each agent makes decisions and under what conditions it changes its behavior. For example, tourists can make decisions based on the distance, price, quality and experiences of other agents. Location of agents and distances between them. For example, distances between tourist locations and attractions or hotels. Maps and the geopolitical situation of the area. Exact location of tourist centers, natural resources (mountains, lakes, forests) and infrastructure (roads, airports, train stations). Visits to tourist centers may depend on the season, so weather and climate information may be included. Transportation options: what means of transportation tourists use (car, bus, train, plane, etc.) and which of them is more efficient. Information about the ease of reaching tourist facilities and the development of the transport system. Financial capabilities of tourists, each agent's budget and price sensitivity. Price of tourist places and services. For example, the prices of hotels, attractions, food and other services. Current tourist flows, the number of tourists during the year and demographic information among tourists (nationality, from which region they come). The ratio of international and domestic tourists and the preferences between them. How information is exchanged between agents and the impact of this information on the decision-making process. For example, tourists can choose attractions or hotels by looking at reviews left by other agents on the Internet or in social networks. How the action of one agent affects other agents. For example, positive reviews about attractions or hotels left by other tourists can attract new agents.ABM often involves dynamic modeling over time, so taking time into account is critical. It allows to evaluate factors such as tourism trends, actions of agents in a certain period (seasonality). Time parameters are necessary to determine how long agents travel, how long they stay at each location, and how they move from one location to another. It is necessary to determine the travel objectives of the agents. For example, some tourists are interested in cultural attractions, while others prefer to relax on the beach. Agents with different goals change their behavior accordingly. What tourism services agents need and how they respond to these services.

Digital maps (GIS - Geographic Information System): GIS data is used to describe the exact location of tourist sites and geographically tourist objects. Through this, agents calculate geographic distances and plan their actions accordingly. Agents evaluate each other's opinions and change their decisions through the interaction of tourists. For example, agents can choose a hotel based on online reviews. It has many advantages in the analysis, forecasting and decision making of complex systems in the field of tourism. ABM enables the realistic simulation of the tourism ecosystem through the individual behavior of agents and the interactions between them. Tourism is a very complex field, in which the interaction of different agents - tourists, tourist facilities, service points, means of transport and local population - plays an important role. By simulating the interactions of these agents through ABM, it is possible to understand how the entire tourism system works. For example, ABM shows how the flow of tourists, the location of service centers, prices and other factors affect each other, through which regional tourism development is analyzed. ABM helps determine how tourism infrastructure (hotels, restaurants, transportation, attractions) should be located. The model can study the travel process of agents (tourists) and determine in which places service centers should be optimally placed. For example, the decisions of tourists such as which hotels to choose, which restaurants to go to, and which attractions they are most interested in are simulated and service points are effectively placed.

In forecasting the flow of tourists With the help of ABM, the flow of tourists, their movement directions and choices are forecasted. It examines how popular tourist destinations, means of transport, prices and services are affected. For example, ABM can help determine when and how tourists move to a particular attraction. This provides an opportunity to predetermine and manage overcrowding in tourism locations. ABM is of great help in planning tourism development strategy. Tourist flows can be managed through effective distribution of tourist attractions, services and resources, marketing strategies and infrastructure improvements. Through ABM, analyzes are made about how to expand tourism places or create new tourist objects, and decisions are made based on this. ABM is well suited for analyzing interactions between agents. For example, tourists change their decisions based on each other's reviews, travel recommendations or information on social networks. ABM analyzes how these interactions occur and how they affect the actions of agents. For example, tourists choose which hotel to stay in or which attraction to visit based on online reviews. To model the behavior of tourists, ABM enables the improvement of tourism strategy by simulating the behavior of tourists. It can be studied how tourists make decisions based on their budget, preferences, interests and other factors. For example, some tourists may be interested in eco-friendly destinations, while others may prefer sightseeing tours. Through ABM, it is possible to adapt tourism services by simulating different behavior patterns. Flexibility and dynamic analysis One of the important advantages of ABM is that agents adapt and make decisions based on their circumstances. It is a dynamic system, and tourists can change their actions according to different conditions. For example, ABM can be used to see how factors such as increased transport prices, increased demand for attractions or climate change affect tourist behaviour. The model dynamically simulates how tourists make decisions. Seasonality and Tourism Flow Management Seasonal changes in tourism can be analyzed and managed through ABM. One can study which places tourists prefer in summer and winter season or how to balance the flow of tourists in crowded places. For example,the behavior of agents traveling to ski resorts in the winter season or tourists focusing on beach tourism in the summer season is simulated. ABM is also used to study the economic and environmental impacts of tourism. It is possible to simulate the impact on the local economy through the flow of tourists, the use of tourist services and resources. Also, ABM helps to study the impact of tourism on natural resources to ensure environmental sustainability. For example, it is possible to analyze how large numbers of tourists congregate in one place will affect the environment and how to manage environmental constraints. Agent-based modeling (ABM) has many advantages in tourism, as it allows the analysis of complex

systems, optimization of tourism infrastructure, forecasting of tourist flow and improvement of tourism strategy. ABM is dynamic and flexible, helping to understand how a system works by studying the individual behavior and interactions of agents. In tourism, ABM is an important tool for accurate modeling of tourist behavior, effective deployment of infrastructure, and environmental sustainability. The above information is required to create agent-based modeling (ABM). This information will be related to agent behavior, their location, transportation options, price sensitivity, geographic information, and interactions between agents. In order to create ABM in the field of tourism, information from various sources is collected and through simulation it is possible to model and understand the behavior of complex systems.It is an important tool for effective deployment of infrastructure and ensuring environmental sustainability. The above information is required to create agent-based modeling (ABM). This information will be related to agent behavior, their location, transportation options, price sensitivity, geographic information, and interactions between agents. In order to create ABM in the field of tourism, information from various sources is collected and through simulation it is possible to model and understand the behavior of complex systems.It is an important tool for effective deployment of infrastructure and ensuring environmental sustainability. The above information is required to create agent-based modeling (ABM). This information will be related to agent behavior, their location, transportation options, price sensitivity, geographic information, and interactions between agents. In order to create ABM in the field of tourism, information from various sources is collected and through simulation it is possible to model and understand the behavior of complex systems.

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